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VILLARD.

All honor to Henry Villard, as a pioneer and large-minded man, who once again showed that among her adopted children America will ever find her most loyal, true hearted patriots. To electrical engineers, Villard will remain an ideal in many respects. It would be difficult to say just how much electrical inventors and their art owed to his courage and liberal support when most needed, but the debt is very large. We are fain to believe he was repaid and that of the wealth left to him after all his superb ventures, a considerable part was derived from electricity. At the best, his reward was none too ample, for while some of the great scientists and engineers were still condemning, he was prompt with the support that carried inventions through to success. Personally, we can only speak of Mr. Villard's interest in electrical development as worthy the keenest intellect, and we can only hope to meet more men like him as the younger electrical arts come forward for financial encouragement.

SIBERIA

We publish in this issue an authentic and most interesting article on the telegraphs of Siberia, which at this juncture are of unusual importance in view of events in China and the development of Central and Pacific Asia. The article gives a variety of information not before obtainable, and confirms the reports already at hand as to the advance of Siberia—an advance that would make any of our Western States proud, and which soon may make some of them rather weary. It has been the fashion to think and speak of Siberia as a God-forsaken, devil-ridden country, and our old telegraphic friend, George Kennan, the whilom associate of Franklin L. Pope, is largely responsible for that idea. As a matter of fact, electrically considered, Siberia is far in advance of England or France, with electric lights and telephones everywhere, good hotels, and vestibule trains with baths, pianos and call bells. In Siberia, Russia has found her Australia, and she is doing pretty well with a region once peopled with convicts, but now destined to be a prosperous granary and home for peaceful citizens.

ELECTRICITY IN ELECTIONS.

As evidencing the power of electricity to annihilate distances at the close of the nineteenth century, we may consider that although the polls in California did not close until 10 p. m., Eastern time, yet owing to the use of the telegraph and telephone the bulk of the election returns were set in type at 2 a. m., ready for publication in the morning papers. Consequently in four hours the Western vote had to be counted, scheduled and telegraphed to the East. Moreover, owing to the fact that the stock market in London opens about 5 a. m., a number of trading orders to London were written out in the United States in the small hours of the night upon the result of the elections being announced. This rapidity of communication contrasts strangely with that existing in the early years of the century, as, for example, when it required more than three weeks to communicate to Washington the news of the battle of New Orleans.

AUTOMOBILISM.

The opinion expressed in these pages last week as to the success of the show of the Automobile Club in Madison Square Garden can but be confirmed and reiterated now. It was the first real thing of the kind in America, and the fact that some 12,000 persons visited the Show on the last day goes to prove the extent of the interest that

exists in the new art and industry. Electricity, steam and gasoline were there in all the glory of spic span vehicles, and the "concert of powers" was most suggestive and instructive to all in every respect; as well as being full of amusement. The officers of the club are to be warmly congratulated on their success and must feel encouraged as to the future of such exhibitions, besides netting a round tangible amount for the purposes of good roads, remedial legislation, etc., that they have in view.

As to the contests, it will be admitted at once that they were a feature of great attractiveness, and were watched with much pleasure every night. It is a cause of much satisfaction that in both braking and obstacle competitions, the winners were electric. We are not inclined, however, to over-emphasize the victory, for conditions in the Garden were perhaps favorable to the light and handy electric "rigs"; besides which, some of the electrical concerns have taken a stand against such contests, of which, broadly, we must express our cordial approval. Still, every one must concede that these trials last week were most impressive as to the ability of the modern automobile of any kind of power and of any tread or bulk to brake swiftly and to thread a safe path through any maze of the city thoroughfares.

Manufacturers report themselves as pleased with the result, although they took action wisely to check the growing tendency to increase the number of automobile shows. They would soon bankrupt themselves if they did not put a sharp limit on that form of expense. There are other ways of reaching the customer, and the vital question is how to create and fill the demand. From personal investigation we can say that a large patronage is to come from a portion of the community very much in evidence at the Show, but not yet reached, namely, the people of moderate means who have never felt able to "keep their carriage" in the cities. So far, automobiles have been built for fashionables and industrials, but in stage lines and in low-cost vehicles a field without limit is opening up. We venture to believe that more automobiles can be sold in this country, for example, to private users, on the instalment plan, than pianos, and the number of pianos thus disposed of runs into more hundreds of thousands than any automobile manufacturer has yet set down in his calculations.

THE ACCUMULATION OF WEALTH IN RELATION TO ENGINEERING.

From some statistics recently published in Washington, it would appear that the total estimated wealth of the people in the United States is about ninety billions of dollars in this year 1900, representing an average possession of nearly twelve hundred dollars' worth of property per unit of population. This represents a gain of twenty-five billions of dollars during the past decade, a gain whose magnitude is directly traceable to the productive power of machinery, which is only another name for the application of engineering and science.

Every compilation of facts concerning national development and every indication of the time, point to the enormous influence of engineering in shaping the destinies of communities and States. The material progress of human beings has been in the past, and is at the present time, a mere reflection of the progress of engineering in the industrial arts. Each invention is in this sense merely a new basis upon which engineering may build. It is gradually coming to be recognized by the practical men of our time that it is to engineering and applied science that the future must look in developing the evolution of nations and races. The great nations of the earth must necessarily be the great engineering communities, whose machinery, electrical or mechanical, compel the forces of nature to accomplish abundantly that which otherwise could only be achieved by slow and wearisome muscular labor.

DEMAGOGUERY.

We have waited until after election to note one of the many flaring, glaring instances of demagoguery of which a well-known New York daily journal was guilty last month in its attacks on capital invested in industries. We do so because in this instance, electrical industry was outraged, and because such vile incitements to discontent and disorder are serious menaces to the public welfare. It happened that the manager of a group of independent telephone companies stated that while negotiating its business in New York he had been a party to orders for apparatus worth $3,000,000, placed subject to Mr. McKinley's re-election; and he added the remark that such re-election meant generally at least four years of good trade and business. Whereupon the journal got off the following with jibes at "lying trusts" that rob the people all the time and "swindle or frighten part of the people" at elections. "In the first place, the statement is, of course, a lie. That particular trust known as the General Electric controls the making of electric material. Its managers know perfectly well that telephones, electric lights, etc., will continue to be used in ever increasing quantities by the inhabitants of this country, no matter who is elected."

What a screed of nonsense! In the first place, the statement is, of course, a lie. The General Electric Company does not do a quarter of the electrical business of the country. Its managers have nothing to do with telephony, and never have had. So far as we are aware, and we ought to know, they have never made a telephone in their lives. If there were a telephone monopoly—which there is not—it would be the American Bell Company, but it will be noted that the utterance attacked by the daily newspaper was made by an "independent" who is fighting the Bell tooth and nail, and the $3,000,000 was for "independent"—not "trust" apparatus.

TRAVELING CONTACTS.

It is remarkable how the types of traveling contacts have differentiated in different countries. In the United States we have the trolley wheel, a small, deeply grooved, light, metallic wheel, and there is very little difference apparent in trolley wheels all over the country. In conduits or in roadways where the public are excluded, we have the rail and the traveling shoe. In Europe the shoe is essentially the same, but the overhead contact is often quite different. For example, in Switzerland are to be found frames pressed upward against the trolley wire and carrying in place of the wheel a simple straight level wire which rubs transversely against the trolley wire. It is claimed for this form of contact that it is simpler, more reliable and much less likely to become disengaged. On a mountain road and on a steep grade it would naturally be of great importance to avoid the risk of having the trolley wheel jump off the wire, and particularly on a three-phase system where two separate trolley contacts have to be continuously maintained. Yet it seems that with this simple mechanical arrangement a disengagement from the trolley wires is practically unknown, and no ropes are provided for the motorman or conductor to reset the harp should it become disengaged. It would be necessary, in fact, for the conductor to climb upon the roof of the car in such an emergency. In this connection it is interesting to note that the Siemens' split tube trolley contact, first used at the 1881 Paris Electrical Exhibition, is still employed on an electric railway at Montreux, Switzerland, and giving good satisfaction.

THE ACETYLENE FLAME.

An interesting paper on this subject by Dr. E. L. Nichols appears in the November number of the *Franklin Institute's Journal.* It has been proposed by various physicists to employ a flame of acetylene

gas burning in air under certain standard conditions, as a readily reproducible luminous source for photometric work. It was considered that the readiness with which this gas could be produced from calcium carbide with a high degree of purity and under readily controlled pressure would enable the photometrist to obtain a long-sought standard of light. Moreover, the whiteness of the flame renders a comparison of such a source with arc lamps much more convenient and effective than when a Hefner-Alteneck lamp is used.

These hopes have been somewhat checked by the results published in the paper referred to. It is shown that the illuminating power of acetylene gas after being stored five months in a gas holder over water was only 6 per cent of that obtained under corresponding conditions with freshly prepared gas, although the color spectrum was approximately the same. In other words, acetylene gas will not keep its illuminating power. Moreover, the illuminating power of this gas is shown to vary with the manner in which the gas is obtained from the same materials of calcium carbide and water. The gas obtained by the "dry process" had only about 80 per cent of the illuminating power of gas obtained by the "wet process." This shows that if water is added to calcium carbide the effective result is not the same as when calcium carbide is added to water.

In spite of these drawbacks, Prof. Nichols seems to think that good use may yet be made of the acetylene flame in photometric work under suitably prescribed conditions, using, for example, a diaphragm through which a certain portion of the acetylene flame can be viewed. In a recent paper appearing in the *Physical Review* the radiant efficiency of the acetylene flame—that is to say, the ratio of the visible to the total radiation emitted—is given as 10.5 per cent, and, therefore, second only to that of the arc lamp.

WITH RESPECT TO DEPRECIATION.

We often have brought to our attention—and it was noted last week in regard to the annual report on the Detroit municipal plant—the matter of the rate of depreciation of electrical plants, and it grieves us, for such questions are enough to ruin any one's reputation for omniscience. Even the redoubtable "person skilled in the art" of patent practice might well turn pale at the inquiry. Yet by this time there has accumulated enough experience in such matters to serve at least as a basis of sound judgment; assuredly enough to justify a preliminary view of the matter. To begin with, there is a vast amount of confusion in the proper meaning to be attached to the word "depreciation" and a corresponding confusion in the evolution of the thing itself. One common and obviously erroneous interpretation is to assume that so long as apparatus is in good condition as regards its operation as it was when new, there has been no depreciation. On this doctrine the famous "one-horse shay" did not depreciate through its entire century of usefulness, until on the fateful morning when it broke down "all at once and nothing first," it suddenly ceased to have further operative value. A view in quite the other direction, but equally mistaken, is that the depreciation of a piece of apparatus is to be reckoned as the difference between its original cost and the sum which at any particular time it would bring as a second-hand machine. This usually does the apparatus an injustice, since it is well known that a very short period of use, quite insufficient to produce any material wear and tear, will reduce the selling value in a manner altogether disproportionate. To our mind, a different criterion should be adopted, taking into account on one hand the physical depreciation, and on the other the operative depreciation which affects the general usefulness rather than the operative efficiency.

According to this view, an electrical plant has at any time in its life reached that value which is obtained by subtracting from the value of a perfectly new, modern plant of equal capacity the sum which would be required to bring the old plant up to the same efficiency and expectation of life. In other words, barring franchises and the good will of the business, an old plant can never have a greater operative value than a new one, thoroughly up to date in design and construction, but the former can be by repairs, replacements and amortization of inherent difference of deficiency brought to an equal operative value. The sum required for this work is the true operative depreciation. And this sum depends not only upon wear and tear, but on the changes in the art. The former can be calculated from experience with at least an approximation to accuracy, but the latter factor is of the most elusive character. The physical depreciation of modern generators is exceedingly small, and perhaps, for example, one of the huge direct-connected, low-tension lighting generators of recent build could be kept at an annual expenditure of 1 per cent for repairs up to its present operative efficiency for a hundred years to come. But suppose in five years the luminescent lamp which has been hovering in the air should suddenly materialize and prove to be operative only by alternating currents. There would be a score of papers read before learned societies to prove the new method impractical and visionary, but in due season competition would do its deadly work and the present generators would be worth simply their value as old scrap, and would have to be replaced. Or suppose that such lamps should fail to work well on alternating circuits—then all the big alternators would come to grief—and so on.

This operative depreciation is a very serious matter, and must be taken into account as best one can. It has been going steadily on for the last twenty years, and has caused the more or less complete reconstruction of perhaps three-quarters of the electric light plants in the United States. It has caused enormous expense which is just as truly depreciation as if the apparatus had slowly worn out like an old coat, and this depreciation is one which the financial management of a plant must in one way or another take into account. The final result can be found in the quotations of second-hand apparatus in our advertising columns. Fortunately such quotations represent the law of supply and demand rather than real operative values alone, so that often a most useful machine can be picked up at a very reasonable price. But no amount of current repairs can avert operative depreciation as the art grows, so we find that, for instance, some open arc lamps in the best of condition, and practically as good as new, may be bought for a few dollars, almost at your own price, and five or ten-light, low-voltage transformers can be picked up for almost nothing. And thus it comes to pass that the apparatus of an electrical plant, however well cared for, is really of lessened value year by year to an amount quite independent of wear and tear.

In fact, however, it is probable that this depreciation, like that due to current wear, is likely on the whole to grow less and less, as the processes of manufacture have been perfected, and the art has settled into better defined lines of progress. Modern generators and transformers leave little to be desired in point of efficiency, and are so well constructed that their physical depreciation is vastly slower than was the case with the apparatus of fifteen years, or even of ten years ago. But the laws of change cannot be avoided, and sooner or later methods are liable to such modification as to demand a new equipment in part or in whole. Of what sort the change in any case will be, it is impossible to prophesy far in advance of the fact, but that changes will come in the future as in the past may safely be predicted. Hence the operative depreciation due in part to changes in the art is one which must be kept in mind, and for which the far-sighted manager will not fail to made due provision, for it is just as much a part of the future of his plant as repairs on the pole lines.

Death of Henry Villard.

A great many people in the electrical field will note with regret the death of Henry Villard, which occurred at Dobbs Ferry, N. Y., on Nov. 12. He was born Heinrich Hilgard, of good Nassau-German stock, at Speyer, in Rhenish Bavaria, April 11, 1835, and after his university studies came to this country in 1853-4. He went West, drifted into journalism, made his mark in both English and German, met Lincoln, Greeley and others, and after varied newspaper experiences, with rising fortunes, married the only daughter of William Lloyd Garrison, the great anti-slavery leader. Early in the seventies, negotiating American securities in Germany, he was brought into close touch with leading bankers in Berlin and Frankfort, and out of these new interests came his trip to Oregon, and the long train of development that has brought about the existence of the remarkable system of the Northern Pacific Railroad Company. The general panic in the early eighties dragged him and the nascent properties down; but his work remained and with it, to him, some part of the wealth due to the development of the region and the transportation system.

But it is Mr. Villard's interest in electrical work and invention that chiefly concerns our readers. He was one of the earliest believers in and backers of Mr. Edison's work in electric light and power, and, associated with such men as G. P. Lowery, J. P. Morgan, E. H. Johnson and others, encouraged his efforts, not only in the perfection of the incandescent light, but in the establishing of central stations. He was, indeed, one of the fathers of the modern central station industry. In due time after the art had developed he brought together the various industrial fragments into which the Edison business had split up, and chiefly with the aid of Mr. Samuel Insull created the great Edison General Electric Company, of which he was president for two years. This was followed up by the alliance with the Thomson-Houston Company and the formation under Mr. Coffin, of the General Electric Company, the largest electrical manufacturing corporation this country has ever seen. Its history need not here be narrated.

Down to the present time Mr. Villard has retained his interest in electrical development in various ways more or less public, and it may be noted that he gave considerable financial support to Mr. F. J. Sprague in some of his later important experiments in the field of heavy electric traction.

Mr. Villard was the holder of a controlling interest in the New York *Evening Post*, to which may be due, perhaps, the large and intelligent attention always given by that influential journal to electrical matters.

The funeral took place at Dobbs Ferry, where Mr. Villard had his country seat, on Nov. 14, and was largely attended by men of distinction from all over the country, including those above named and many others, prominent in electrical affairs, assembled to pay their last respects to the memory of one who had done so much to promote, financially and industrially, the advance of the electrical arts in America.

Electrical Men in the New York Sound Money Parade.

A final meeting of the Electrical Industries Association, which organized the big electrical division in the Sound Money Parade of Nov. 3, was held on Nov. 8, when reports were presented from the various committees. It was shown that considerably over 4000 men marched in the division, and that the expenses of about $2,500 had been met by the liberal subscriptions turned over to Treasurer Patterson. Hearty thanks were voted to President Keefer, Marshal Shippy and other officers, and it was voted to keep up the organization with the present officers and executive committee. Mr. C. S. Pease, of the Sprague Company, who had taken charge of the material used in line, was requested to place the large banner of the association on the walls of the office of the Electrical Trades Society, where the meetings had been held.

As to the parade itself, there was great gratification over its success, as well as at the sturdy behavior of the marchers despite the weather. Mr. C. P. Bruch, who commanded the fifth, or miscellaneous, subdivision, has issued the following order to his staff:

"A great many compliments upon the size, fine appearance and excellent marching of the Fifth Subdivision of Electrical Industries in the Sound Money Parade last Saturday have reached me. I take pleasure in transmitting these compliments to the commanders and members of the various companies—to whom the credit is really due. I desire, at the same time, to express my own appreciation of and thanks for the enthusiasm and earnestness shown by the rank and file of the Fifth Subdivision, who formed promptly, maintained their formation during the long and tiresome wait before we were ordered into line and made the long march in spite of the very unfavorable weather. We may congratulate each other upon the result of the election, which the parade of Saturday unquestionably helped to attain."

Submarine Cables and Diplomacy.

The subjoined is from the Boston *Traveler*: A writer on electricity says the cable will banish the diplomat; and, curiously enough, a great American diplomat sustains the view, though all unconsciously. Diplomacy—just now the most prominent of the governmental functions of the United States as well as of "the powers"—will be carried on by cable in the future, says an editorial writer in the ELECTRICAL WORLD AND ENGINEER. Electricity, says this writer, has made diplomacy obsolete, and ambassadors are hardly more than district messenger boys. "Now that a cable message can convey to a minister the wishes of his Government, he ceases to be a personality, and becomes more and more a mouthpiece. The only present use of the Chinese Minister in Washington is that of a district messenger, carrying cable messages to the White House."

It is interesting to find this view unconsciously corroborated and promulgated by an American diplomat who, with the exception of John Quincy Adams, has seen longer service in the State Department of his country's government than any other man. Former Secretary of State John W. Foster has recently published, through Messrs. Houghton, Mifflin & Company, "A Century of American Diplomacy," and in the course of his popularly written and interesting review of American foreign relations since 1776 says: "An event which occurred in 1866—the successful laying of the Atlantic telegraphic cable—has had a greater influence on the methods of diplomacy than any other physical fact of the century; and it is gratifying to note that this achievement was mainly the result of the untiring efforts of an American, Cyrus W. Field. Mr. Seward, in his dispatch of congratulation to Mr. Field, said: 'If the Atlantic cable had not failed in 1858, European states would not have been led in 1861, into the great error of supposing that civil war in America would either perpetuate African slavery or divide this Republic'; and he added: 'Your grand achievement constitutes, I trust, an effective treaty of international neutrality and non-intervention.'"

The point overlooked by the writer in the ELECTRICAL WORLD AND ENGINEER is that a minister is sent abroad not only to transmit messages, but to take observations, to know what is going on about him; and his value in this capacity Mr. Foster's narrative review abundantly shows.

Independent Telephony in New York State.

We have received a letter from Mr. C. O. Harris, superintendent of construction of the Rochester Telephone Company, 59 Stone Street, Rochester, stating that there is a desire on the part of many of the independent telephonists of New York State to get together in some kind of organization. This body would be formed for mutual benefit, interchange of ideas and plans, and better acquaintance with one another. The time is coming, Mr. Harris thinks, when with the extension of the independent enterprises, the companies will have to do considerable business with one another, and it is time that they were on a better footing of personal intimacy. Mr. Harris says he is perfectly willing to take up the preliminary part of the organization, and he will be glad to have any one interested drop him a postal card signifying willingness to help along such a cause, or offering any suggestion as to its formation and work.

To Convert a Steam Road.

Joseph W. Coffin, of New York City, is in Indiana in the interest of a project for an electric line from Fort Wayne to Lafayette, through Logansport. If built, the Eel River Railroad may be converted from a steam line into an electric road, and consolidated with the new company.

Lighting the Monumental Gate of the Paris Exposition.

THE illuminations of the Paris Exposition, when shown in all their splendor, as, for example, on special fête days or on "select Friday" evenings, are strikingly beautiful, and well repay the time necessary for a complete survey of the artistically lighted exteriors of the numerous palaces, and the avenues of lamps which exhibit the possibilities of all kinds of illumination. Among electrically lighted portions of the Exposition none is perhaps more prominent than the splendid façade of the Electricity Building on the Champ de Mars, which has already been fully described in these columns; but the lighting of the Monumental Gate at the Place de la Concorde has been laid out with a view to the most picturesque ef-

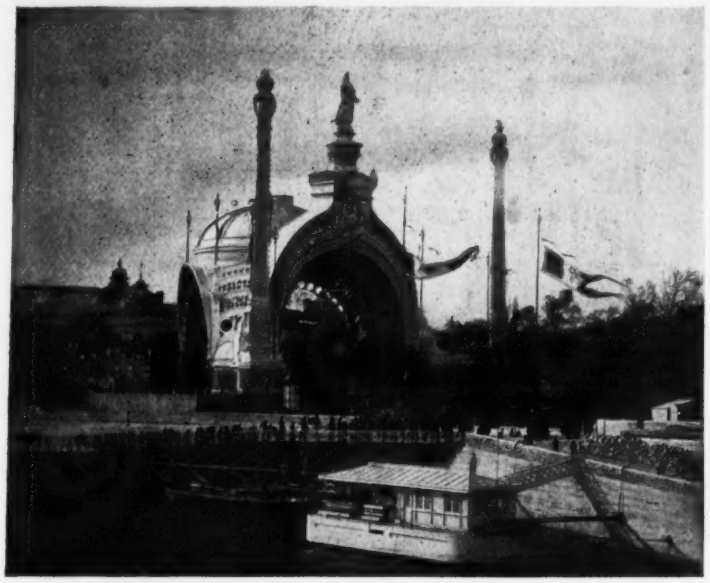


FIG. 1.—MONUMENTAL GATE, AS SEEN FROM THE RIVER.

fects, although it is unfortunately true that the work of installation was hindered by the city authorities to such an extent that the original intentions of the designer were not realized, and much of the possible and inherent beauty of effect is unutilized and lost. The general treatment of the gate is a design in blue, green and gold studded everywhere with colored electric lamps in blue and yellow. On each side of the main arch are curved walls branching out as if to gather in the visitors and ending in the tapering minarets whose four faces are covered with blue and yellow lamps. The chief part of the curved walls is used for designs in relief illustrating on one hand the agricultural and allied industries and on the other the electrical and mechanical achievements of the age, by representative figures forming, as it were, a procession towards the central arch. Beneath these two panels are animals of various kinds in bas-relief; lions, bulls, bears, tigers, etc., all forming another procession in one direction, from left to right, as if entering on one side and emerging on the other. Over the main arch, after the manner of a keystone, is the prow of a ship, and above it, standing on the deck with outstretched wings, is the typical "Gallic cock," a defiant golden rooster. Higher still, to crown the arch, the much-criticized Parisienne stands forth in stately pride of ostentatious garb.

The entrance gate consists actually of three arches united to a common centre which forms a dome, the principal arch being in front and the others rising over the radiating ticket offices or individual entrance "guichets," which spread out in the form of a fan. A central gate is provided, however, for special occasions, and is made of iron lattice work gilded and decorated with colored coats of arms of illustrious French patriots of long ago. Below the main arch are two alcoves which give shelter to what are supposed to be figures typical of electricity. As a matter of fact, these figures were intended to be placed on magnet bases which should signify the meaning in a more definite manner, and they were to stand on pedestals outside the gateway. But the city fathers were fearful that some irreparable damage would be done to the roadway if the Exposition artists had their way, so the statues were bereft of their bases in order that they might fit into the niches in the arch, and the proposed fountains which should have flowed within those alcoves were also omitted.

A casual glance at the Monumental Gate, and even a superficial examination, would lead one to suppose that there were many thousands of lamps installed; for at almost every point there may be seen the colored globes which are used to protect the incandescent lamps and give the required effect without the necessity of coloring the lamp bulbs themselves. There are over three thousand of those colored globes, but the total number of lamps is only 1385. Many of the globes have, therefore, no lamps within them, but serve simply to cover corrugated mirrors fastened to the outside of the structure. Nearly all the lights that are used, facing the front on the Place de la Concorde, are of a bluish purple, so that the first impression of a visitor approaching from the brilliantly lighted square is that the illumination of the gate is not yet effected. It is a pity that a better showing is not made, because there was every intention of making the most of the opportunity; but again the local authorities, with their mania for keeping the city streets undisturbed, put their veto in the way. It was proposed to have search-lights installed temporarily on the Place de la Concorde and on the sides of the gate at the back, and with this object in view the mirror lamps were installed, it being intended that the reflected light on the corrugated surfaces should give the effect of light within the globes, thus increaing the amount of colored illumination throughout. The authorities decided, however, that search-lights would disfigure their beautiful city, and they had to be abandoned. These mirror lamps were not the only decorations to suffer for want of light. Throughout the whole work there has been used a quantity of tinsel which shines brightly in the sunlight with blue and gold and green, and it was expected that the effect of the search-lights upon its surface would add materially to the beauty of the gate at night. As things are, the illumination as seen at first, while the eye is still dazzled with the brilliancy of the Place de la Concorde, reminds one of the Gilbertian couplet about the "Greenery-yallery, Grosvenor Gallery, foot-in-the-grave young man," typical of a decadent school in art and architecture.

The color designs as seen by daylight are very pretty. The wide band on the wall which is provided for the groups of figures repre-

FIG. 2.—CREST OF ARCHWAY, MONUMENTAL GATE.

senting industries, is carried round to the inside of the arch, but beyond the figures the space is filled with yellow mirror lamps on a pale blue ground with green leaf decorations and a relatively small number of red spots to give brightness. Above this is a narrow band of blue and gold tinsel, and below it one of blue and green, painted. The inner edge of the main arch has a lace-like fringe with projections upon it like golden knots of cord; then comes a band with blue-gold crosses, and next a row of medallions surrounded by lamps. The medallions are green, with a green lamp in the centre, and a hexagon is formed around each by blue lamps. Since these hexagons coincide at their edges with succeeding ones, there are four blue lamps to one green. This part of the archway is called the "voussure," or vault, and has forty-three of these medallions, consequently 43 green lamps

of 5 candle-power each, and 178 blue lamps of 16 candle-power, counting those at the beginning and end of the vault. All the blue lamps used in the illumination are of 16 candle-power, on account of the large absorption of light by the blue globes; but the green lamps, as well as the yellow ones, are sufficiently bright when of 5 candle-power. Round the semi-circle of the vault is a row of yellow mirror lamps, and next to it a divided crescent with the points downwards, starting from either side of the ship's prow and edged with narrow bands of blue tinsel. The two halves of the crescent are studded with blue lamps, 54 on each, which start in three rows at the top and narrow down to a single row at the point of the crescent. Interspersed between these lamps are small yellow mirror lamps, and outside the whole is yet another row of yellow mirror lamps. The abutments of

FIG. 3.—THE STATUE OF ELECTRICITY, MONUMENTAL GATE.

the main arch, on the curved wall, are decorated in a pretty sparkling design of blue crosses on a ground of green and gold and white.

The side arches are liberally decorated with color work and tinsel, and the open-work design is well supplied with the little mirror lamps in yellow to mark the outlines. The dome forming the central portion of the gate has a crown of 312 blue lamps on the interior, forming a band over the crown of the arches. In the centre is a circle of twelve arc lamps of 12 amperes, grouped in six circuits of two lamps each on 110-volt mains. The lamps have to be trimmed from above, as it is not expedient to lower them to the ground. They are suspended from the dome by steel cables wound over a drum, so that they may be drawn up to a circular opening to be trimmed. Current is supplied to them by two twisted cables to each terminal, providing a double circuit which allows of removing a wire if it should be damaged.

The statues in the niches are lighted each by forty 5 candle-power lamps placed in a row behind a projecting edge of the alcove. The lighting of the ticket offices, though not strictly a part of the illumination, had nevertheless to be provided for, and 176 lamps are used in this part of the structure.

The minarets, 125 ft. high, forming the outermost points of the gate, are of the same general tone as the archway proper. If the search lights had been installed as was intended, the effects at night would have been very pretty, for the yellow mirror lamps would have been visible, whereas they are unnoticed after dark. Commencing from the bottom, it will be seen from the engraving that there is a rectangle covered by lamps. There are on each face three vertical rows of five yellow lamps each, and between these rows are two rows of blue mirror lamps. Below each of these rectangles are four blue mirror lamps in a row, on each face of the minaret. The shaft of the minaret appears in daylight to have a uniform arrangement of blue and yellow lamps following alternately in horizontal and vertical rows throughout; but in reality it is seen by the night illumination that the three lower yellow globes, forming a triangle on each face, are the only ones of that color to contain incandescent lamps, and all the other yellow globes of this series have simply mirrors within. The blue globes, 42 in number on each face, and which are distinguishable by their larger size, are all provided with lamps. The top of the minaret is crowned on each face with a single yellow lamp of 5 candle-power of the same intensity, that is, as the other yellow lamps. Each face of each minaret has thus 61 lamps, or 244 in all, per minaret, of which 168 are blue and 76 are yellow.

The distributing system for power and light in the Exposition is all provided in duplicate. There are nine principal lines of cable running from the main switchboards of the Champ de Mars engine rooms to different parts of the Exposition, and a total length of cable of 45 km.; while in the engine rooms alone there are 14 km. of cable connecting the machines to the switchboards. The line which supplies current to the Monumental Gate is No. 7; and the lighting of the new Alexander III. Bridge, the United States National Pavilion, the United States Invalides section and the Publishers' Building is all done by means of current transmitted through this cable, which is supplied by Berthoud & Borel. Each cable in the Exposition service may be fed from two or three different machines, as may be desired, to guard against breakdowns of the system. Line 7 is supplied from the Schuckert alternator or the Lahmeyer alternator in the German section, the current being three-phase at 5000 volts. The transformer station in the National Pavilion has four Lahmeyer transformers of 20 kilowatts each, the Invalides section has two Schuckert transformers of 50 kilowatts each, and in the Publishers' Building there is one by Schuckert of 20 kilowatts capacity. Three conductors of 30 sq. mm. compose each cable.

The transformer station for the Monumental Gate is at the Champs Elysées side of the main arch, within the building itself, which is constructed of wood and staff, the framework being steel. There are here, in station No. 20, two Schuckert transformers of 50 kilowatts each, of the vertical three-legged type, and two similar ones in reserve, the e. m. f. being reduced from 5000 volts to 110 volts. The main switches are all located in the room at the base of the Champs Elysées minaret; but a supplementary switchboard is placed within the main arch at its centre, directly beneath the Parisienne, access being had by a ladder which starts from the ground with a slight backward leaning, and curves round inside the arch frame over the

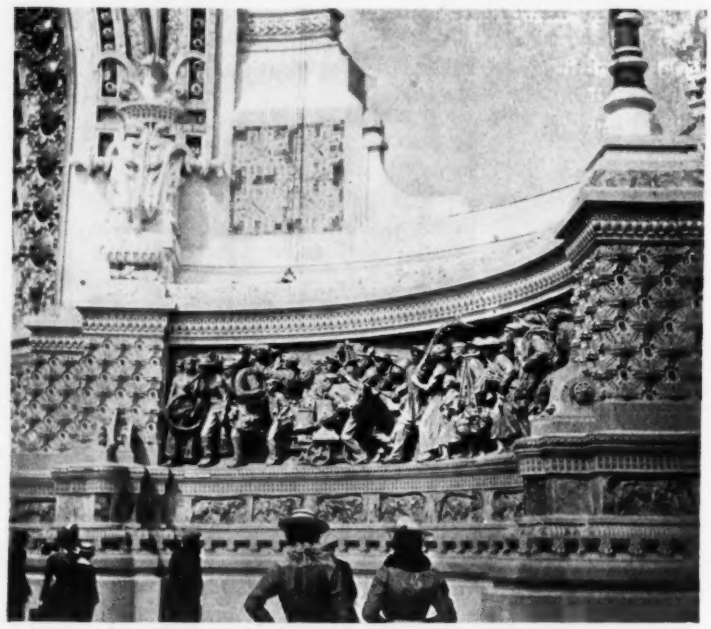


FIG. 4.—THE DYNAMO STATUARY PANEL, MONUMENTAL GATE.

centre and down the other side to the ground. The supplementary switchboard is intended to control the lighting about the upper part of the structure, in order to avoid running many heavy cables down to the main switchboard. For the cupola lighting three cables of 80 sq. mm. are provided, and for the minarets three cables of 20 sq. mm. The lamps used for decoration have bayonet sockets fixed to square tin plates, the rubber-covered wires entering at the back. These plates have parallel slots at opposite corners, so that they may be slipped over screws at either side of and behind the colored globes.

The brilliant lighting of the Place de la Concorde makes the duller colors of the gate show in unfavorable contrast, and a much better idea of the actual value of the illumination is obtained by observing the effect from the gardens behind the arch, as it is there relatively

dark, and the blue minarets look very pretty tipped with their golden stars. If, therefore, the gate could have been transported to another spot where no other lights could dim its brilliancy, or if it had been used as a chief entrance to the Annex at the Bois de Vincennes, the beauty of its illuminated surfaces would have aroused much more enthusiasm than is now generally expressed, and more justice would have been done to its designer, M. Binet, who is one of the best-known decorative artists of France.

PARIS EXPOSITION NOTES.

VINCENNES.—It is rumored that some of the exhibitors at Vincennes wish yet another prolongation of the Exposition after the 12th, to apply only to the Annex, so as to draw a crowd over there for a final grand demonstration. Perhaps the restaurateurs are at the bottom of that, as was the case at the Champ de Mars.

THE MOVING SIDEWALK and electric railway have had another reduction in hours of operation, and close down at 7 o'clock in the evening. Very little traffic is done after dark, and few visitors patronize these means of communication after half-past five, when the Exposition buildings are closed and the greater number of pleasure seekers leave the grounds.

FREE DAY.—Wednesday, Nov. 7, is set as a free day at the Exposition, and all Paris and as much of France as can manage it will come to get something for nothing. This idea seems to be intended to give the ticket sellers a day off to visit the wonders of the palaces, for a man must be poor indeed who cannot afford to buy an entrance ticket when they have come down to three cents or less.

THE TRANSPORTATION FÊTE as originally planned has been abandoned, as many of the owners of the various historical vehicles on exhibition have signified their unwillingness to allow them to be used in a procession, lest they should suffer damage. On this account it is probable that an automobile procession will be arranged to take the place of the historical show, and a transportation fête on these lines is now being considered.

THE PROPOSED TESTIMONIAL to M. Picard, Commissioner-General of the Exposition, to be offered on behalf of exhibitors and admirers as a mark of appreciation and gratitude, has fallen through. That gentleman has announced to the press that he had heard rumors of

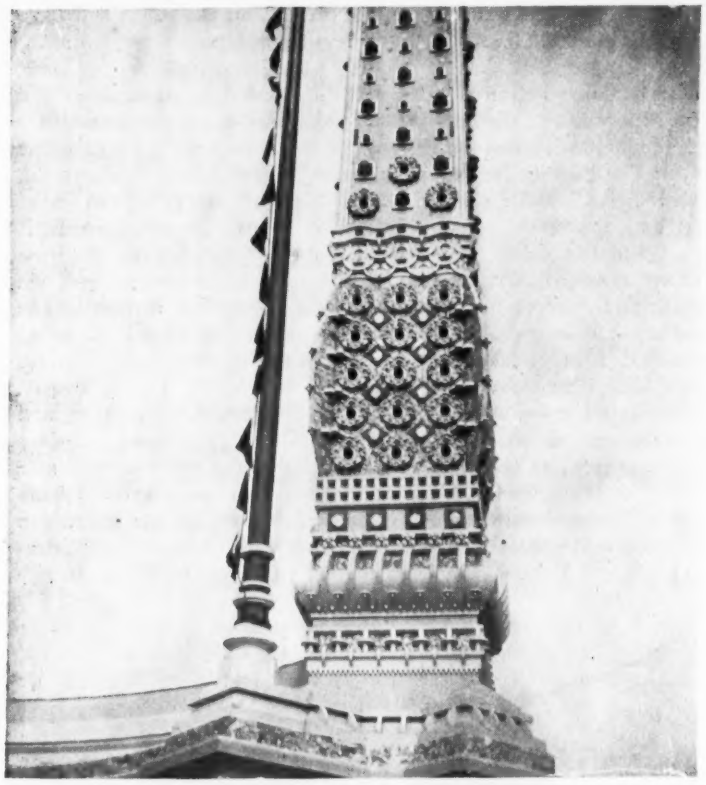


FIG. 5.—BASE OF MINARET COLUMN, MONUMENTAL GATE.

the preparation of various presents to be offered to him by exhibitors and others; that he had not been consulted in the matter and would refuse to accept gifts proffered in that manner. Exhibitors in general have also been quite averse to such a presentation, and the Commissioner-General was doubtless well aware of the fact and had no desire to figure as the principal in an amusing farce.

THE CONTINUATION of the Exposition for another six days is definitely announced, and is in general deprecated by American exhibitors, who see no useful purpose that may be served by such prolongation. In many cases this decision of the administration will make small difference as to the date of packing of exhibits, and the public will be treated to a show similar in some respects to that wit-

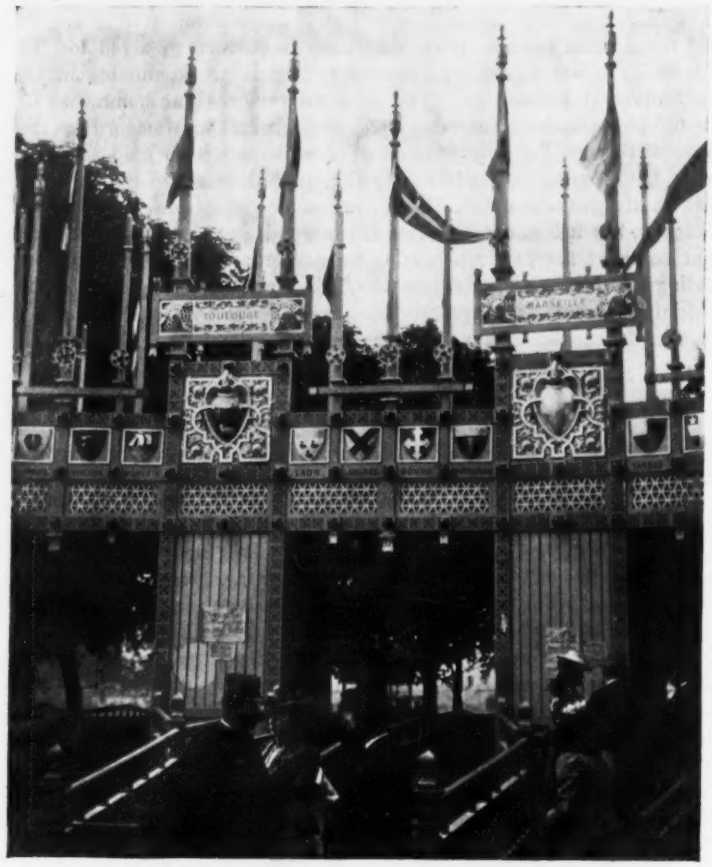


FIG. 6.—ONE OF THE ILLUMINATED GATES, MONUMENTAL ENTRANCE.

nessed during the first few months after the official opening in April. There is, in fact, no regulation which can prevent exhibitors who are so inclined from beginning to dismantle their goods or apparatus as soon as the 5th of November is past, so that there is little dissatisfaction expressed, and the restaurant keepers will enjoy a few days of grace, Nov. 11 being the last day.

THE END.—After a few more weeks the same signs will be visible of dirt and chaos that were evident before the opening of the show. The Machinery Hall is to be torn down, and the ground it occupies laid out in gardens. One of the first structures to be demolished will be the moving sidewalk and electric railway, and the nerves of some of the residents near the line of travel will at length be at rest. Suit has been entered against the company operating these roads, for disturbing their peace, by several inhabitants who experienced annoyance from the rumble of the wheels. It is difficult to understand how the moving platform could be much of an annoyance to any one, especially as, even in summer, it was never in operation much after 11 p. m., and Parisians are not credited with seeking their beds at an early hour of the evening.

ONE OF THE CRANES in service near the Army and Navy Building is built by Mohr & Federhaff, of Mannheim, Germany, and uses three-phase motors for its operations of raising weights and for travel, these being supplied by Siemens & Halske, of Berlin. The crane is especially intended for harbor use, and the house containing the motors and gear is supported on a four-wheeled frame running on rails. The house turns about a central shaft on four wheels on a circular track, and has a radius of action of over 30 ft. The crane exhibited here is supplied with current by overhead cables, at 200 volts, 50 periods. When installed for permanent use, a conduit is built between the rails, carrying the three conductors, one above the other, and a plough secured to the frame of the crane is provided with the necessary contact shoes.

REWARDS of one sort and another are the order of the day for most of the participants in the Exposition of 1900, and the administration chiefs are having their share. One of the latest propositions is to pre-

sent to M. Alfred Picard, Director-General, an immense "Parchment of Honor" having a surface of five square metres—size evidently counting for a good deal in the estimate of value. This parchment, which is already in course of preparation, is to be furnished with a handsomely carved frame, and will be presented to M. Picard as a souvenir of the Exposition by "exhibitors and admirers," as the descriptive circular says. These are requested to contribute each the sum of one franc towards defraying expenses, in demonstration of sympathy and recognition towards those who have so powerfully acted for the success of this magnificent example of human work and ingenuity, the Universal Exposition. The proposal reminds one somewhat of the old plan of presenting school teachers with a Christmas gift at the close of the term, a proceeding imbued perhaps with a glad sense of relief from oppression, while only the specially favored pupils acted in a really grateful spirit. There are some exhibitors in the latter category, but it is safe to assume that a good number would consider that some of the comic papers come nearer an expression of their feelings in the suggestions they make for rewards to the heads of the administration.

The Telegraph System of Siberia.

By H. L. Geissel.

NOTE has been made in New York newspapers within the last few days of the finding of relics in Alaska of the old transcontinental line that was to give the United States almost direct and continuous communication by land, across Siberia, with Europe. So far as the writer is aware, the Russian part of the enterprise has never been narrated in this country. It was an episode of singular international interest. The present situation is not less important.

Some forty years ago the then chief of the Russian Ministry of Ways and Communications, General Tschewkin, submitted to the Siberian Committee a proposal to connect St. Petersburg with the shores of the Yellow Sea by means of a telegraph line. This proposition was accepted, and at the same time it was suggested that this line be extended from the seashore by a cable to America. Mr. L. Gerhard, who was at that time director of the telegraph department, and to whom the early development of the Russian telegraph system is chiefly due, started the work on this great line with much energy, and in 1861 the line Kasan-Tiumen, 1356 versts in length, was completed. This line formed the first link between European Russia and Siberia. One year later, in 1862, the line was prolonged as far as Omsk, and in 1863 Irkutsk, on Lake Baikal, was reached. After the connection had been completed so far, the further construction was conferred upon the American, Collins. The latter's scheme was the following: To build a line from one of the Northwestern Pacific States via British Columbia, the Behring Straits, and across that part of Asia bordered by the Sea of Ochotsk to the mouth of the Amur River. For the construction of the line from Irkutsk to the Pacific Coast the Russian Government appropriated the amount of 900,000 rubles. Work on this line was started in 1865, but it met with immense difficulties. The lack of any means of communication rendered the surveying of the line and the transportation of the required materials almost impossible. The latter had to be transported over long distances by means of pack animals, and the roads had to be cut out of the dense virgin forests. If one adds the lack of workmen and the immense difficulty in securing labor in almost uninhabited, vast tracts of land, it will be apparent that it was no easy task to establish a telegraph system through these parts of Siberia. All the materials required for the construction and equipment of the line —with the only exception of the supporting poles, which were secured on the spot—had to be shipped thousands of miles over the ocean to Nicolaiewsk. In many instances the insulators had to be fixed on trees. In order to afford quicker transportation in the interior, the Telegraph Administration purchased some steamers to be run on the Amur and Schilka rivers, but as the navigation on these rivers is open only during a few months of the year, these means soon proved to be insufficient. It must also be borne in mind that the constructors of the line were compelled to build dwellings along the route. But in spite of all these difficulties and dangers the work was rushed with such energy that in 1866 the line had been extended from Irkutsk to Werknedinsk and Stretensk (1185 versts). At the same time poles were erected along all other parts of the route in order to prepare the line for its connection with the proposed cable

At this period, however, a highly important incident occurred in the history of the development of the world's telegraph system. In July, 1866, the transatlantic cable between Europe and America was completed. As a consequence, work on the construction of the Russo-American Telegraph Line—which had already made good progress—was stopped, as the American company declared that it would not be able to compete in any way with the transatlantic cable. At the same time the Russian Government ordered the abandonment of work on the extension of the Siberian line.

Nevertheless it was felt more and more in administrative and influential commercial circles in Russia that the immense territories of Siberia could only successfully be controlled by means of an extensive telegraphic system, and in May, 1869, an imperial ukase ordered the prolongation of the Siberian telegraph line to Blagovestchensk, Chabarowsk, the port of Novgorod and to Nikolaiewsk

On the 25th of June, 1869, after an intermission of almost three years, work on the line was taken up again at Stretensk. Eighteen months later, namely, in the middle of December, 1870, telegraphic communication with Chabarowsk was established, and in 1871 the Pacific Ocean was reached at Vladivostok. At the same time the old telegraph line, Chabarowsk-Nikolaewsk, which up to that time had only been used for political purposes, was taken over by the Telegraph Administration, which was compelled to rebuild the entire line. Thus finally—and after the greatest difficulties had been overcome—was completed the longest telegraph line of the world, for this line, from Kasan to Vladivostok, has a length of 8330 versts (5523 miles). At the same time of the completion of the Siberian telegraph line, the Danish Northern Telegraph Company started to lay the cable from Vladivostok to Nagasaki, Japan, and from Nagasaki to Shanghai. The Northern Telegraph Company started this work in August, 1871, and on Nov. 5 of the same year—eight months after a telegraph office had been established at Vladivostock—the first telegrams were sent over the great Siberian telegraph line between Europe, America, Australia and the countries of the Far East.

It should, however, be mentioned that the Siberian telegraph line soon proved to have many deficiencies, especially on the section east of Irkutsk and in the Amur district. This cannot be surprising when considering the circumstances under which the line was built. One of the most disagreeable features was that the wires, which were 4 mm thick, were found to be insufficient in electrical as well as in other technical respects. It was therefore decided to equip the line with wires of 6 mm, but this was not carried out until 1894 and 1895. Since that time the line has been in regular and satisfactory working order.

The late war between Japan and China showed particularly the great importance of the Siberian telegraph line—especially its political and administrative importance—but at the same time it also became known that further improvements were needed. It was, above all, observed that the line was not able to cope with the great number of telegrams, especially cipher messages of several thousand words, it received almost daily. In order to remove this drawback the Russian Government established in 1896 a second line from Omsk via Tomsk and Irkutsk to Stretensk, at the same time increasing the number of Hughes apparatus at the offices in Tomsk, Irkutsk, Stretensk, Blagovestchensk, Chabarowsk and Vladivostok. Besides this, a direct line from Libau via Moscow, Samara, Omsk, Tomsk, Krassnoiarsk, to Irkutsk, was established during the year 1897, and the translators at the Kansk and Obi offices were doubled. Besides the great main line, the Siberian telegraph network has a considerable number of branch lines, some of which are of the greatest importance. Most prominent among these branch lines are the following: The telegraphic connection between Omsk and Tashkent—via Semipalatinsk and Verny—completed in 1873; the line to Kiatka, a city on the Chinese frontier, built in 1875 and opened the same year; this line is of great economic and political importance, as it can easily be connected with Peking: the lines connecting Chelampo with Blagovestchensk, and Chun-Tun with Novokiewsk, near Vladivostok. Mention should also be made of the line to the Island of Saghalin, established by the Russian Government during the year 1881.

The official statistics obtainable on the operations of the Siberian telegraph system present an interesting picture of the steady increase in the traffic of the different lines. During the first year after the opening of the main line to Vladivostok, in 1872, the number of telegrams dispatched was 432,412. In 1885 the number had increased to no less than 2,402,981, the annual traffic during the period of 13 years thus having increased by 151,582 telegrams. The abolition of the so-called zone-tariff in 1886 had a great influence upon the business operations of the Siberian telegraphs, as the rates under this tariff were very high, a telegram of 20 words costing as much as 7

rubles. The new tariff fixed the rates as follows: 5 copecks (1 ruble = 100 copecks = 52 cents) for each word for telegrams within Siberia proper; 10 copecks per word for telegrams between European Russia and Siberia. The beneficial influence of this new tariff was soon shown. In 1887 the number of telegrams dispatched over the Siberian lines was 2,976,149, the traffic thus increasing within scarcely two years by 573,168 telegrams. During the following ten years the average annual increase amounted to 266,000 telegrams, and in 1897 the number reached 5,636,186. As far as the transit-traffic carried on over the Siberian telegraph line from Europe, America and Australia to China and Japan is concerned, it may be said that during the opening year of the line, 1872, the number of those telegrams was 6000, while it amounted during the year 1898 to 63,700. For all transit-telegrams dispatched over the Siberian line Russia receives 2.25 francs (45 cents) per word, the income from this source thus being a considerable one. In 1898 alone the number of words of these transit-telegrams increased by 116,705 words, as against the previous year, thus increasing the receipts of the Russian Telegraph Administration by the amount of 262,586 francs.

The Induction Motor—III.

By B. A. Behrend.

THE SHORT-CIRCUIT CURRENT AND THE LEAKAGE FACTOR.

An invaluable aid in the design of polyphase motors is afforded by the short-circuit current characteristic. In a motor having a squirrel-cage armature, the starting current under different voltages is identical with the short-circuit characteristic. If the resistances of the armature and of the field were known, the power factor of the feeding current could be calculated; thus it would not

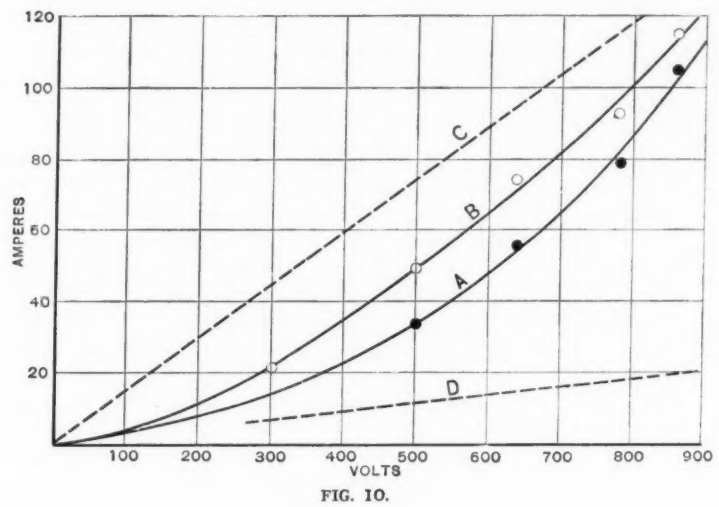


FIG. 10.

even be necessary to use a wattmeter unless very accurate measurements were required. Theoretically, then, the short-circuit characteristic is sufficient for the determination of the leakage factor; in practice, however, it will, in the majority of cases, be inadvisable to depend upon the short-circuit curve, on account of the corrections which become necessary. If the total resistance of the motor is small, the lag of the current amounts to nearly a quarter of a period; the inductance of a motor at standstill (short-circuit) should always be as small as possible; therefore, a very large current will go through the motor at full voltage. Now, the leakage factor is always more or less dependent upon the strength of the currents which cause the leakage, hence the leakage factor at starting with only a small resistance in the armature may be very different from—as a rule, smaller than—the leakage factor upon which the diagram is constructed. In fact, we do not work the motor in that quadrant of the semi-circle, which corresponds to the short-circuit characteristic. If, therefore, I shall not make much use of the short-circuit curve for the determination of the absolute value of the leakage factor, I shall all the more avail myself of it for comparative purposes where it does not so much matter whether the absolute value is correct or not, but where the relative value is of importance. Such questions as the influence of a closed or open slot, of the number of slots, of the air-gap, and of the pole-pitch upon the leakage factor, can all be answered by consulting the short-circuit characteristic. I shall proceed to discuss, point for point, the influence of these factors on the leakage coefficient.

THE SLOTS.

The curves *A* and *B*, in Fig. 10, represent the short-circuit characteristics for a closed slot of the shape marked *A*, and of the open slots of the shape marked *B*. The slots of the armature were closed in each case. Curve *C* shows the ideal short-circuit curve obtainable only if the leakage paths contain no iron at all. Curve *D* is the magnetizing current reduced from the measured value of 42.2 amperes at 1900 volts to the various voltages in the diagram. The increase of the magnetic reluctance of the main field through the opening of the slots proved too small to influence the magnetizing current in any perceptible manner.

We see that for voltages above 600 the curves *A*, *B*, and *C* converge: in other words, the short-circuit current at the full voltage of 1900 will be almost the same whether the slots are open or closed. Hence the maximum flow of energy which can be impressed upon the motor is by no means so much dependent upon the form of the slot as would appear at first sight. The tendency of the closed slot is to change the fundamental diagram in the way shown by the full line curve in Fig. 11. From this curve follows that, though the maximum power factor is 0.715 instead of 0.755, and the current for the same output 58 instead of 55, yet the maximum output of the motor is hardly reduced as the maximum ordinate of the semi-circle, represented by the broken line, is only inconsiderably larger than the maximum ordinate of the full line curve. If the iron bridges are kept very thin, excellent motors can be built with closed slots, in no way inferior to motors with open slots. The objection to closed slots, then, resolves itself—neglecting at present the load losses which may probably be caused by the bridges—into a commercial one, viz., the question is, Which slot is cheaper? Labor being expensive in America, it is cheaper to wind the coils on forms and to use open slots. The cost of labor being considerably smaller in Europe, some of the leading builders of polyphase motors have preferred to use closed slots and to wind by hand. Coils wound outside of the machine require more insulating material, and as the room is always somewhat scant in polyphase motors, the European method offers some advantages. On the other hand, we have to bear in mind that the greater ease

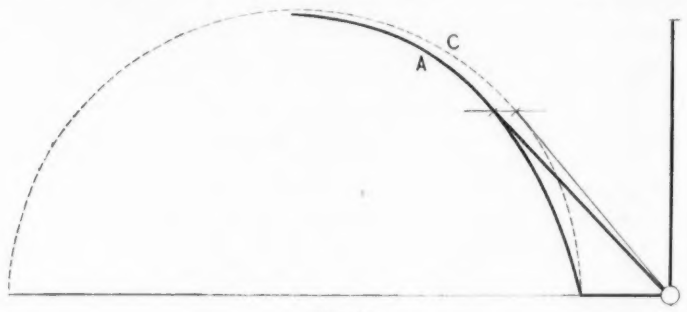


FIG. 11.

with which machine-wound coils can be exchanged, should not be underrated, and might even be bought with the loss of another advantage. A design is more or less of a compromise, and the best design is that which combines the greatest number of advantages with the least number of drawbacks.

NUMBER OF SLOTS PER POLE.

A little consideration teaches us that we obtain the least amount of fluctuation in the field the more slots we have per pole. Theoretically, then, it would be advisable to have as many slots as possible. From a commercial standpoint, however, it is advisable to have as few as possible. Either extreme is impracticable; we must try to strike the golden mean.

The influence of the number of slots upon the leakage can also readily be seen. The more conductors we have in a slot the larger will be the leakage field surrounding the slot. The active field is—with enough accuracy for our present consideration—the same

whether we distribute the same number of conductors in a few slots or in many. The e. m. f. induced by this field upon these conductors may, therefore, be set constant independently of the number of slots. Let us take a concrete case. If we have, for instance, 100 conductors arranged in 5 slots, there are in each slot 20 conductors. The leakage field per slot is produced by these 20 conductors, hence proportional to their number. The e. m. f. induced by the leakage field per slot in the 20 conductors in each slot is proportional to 20 times 20. Hence

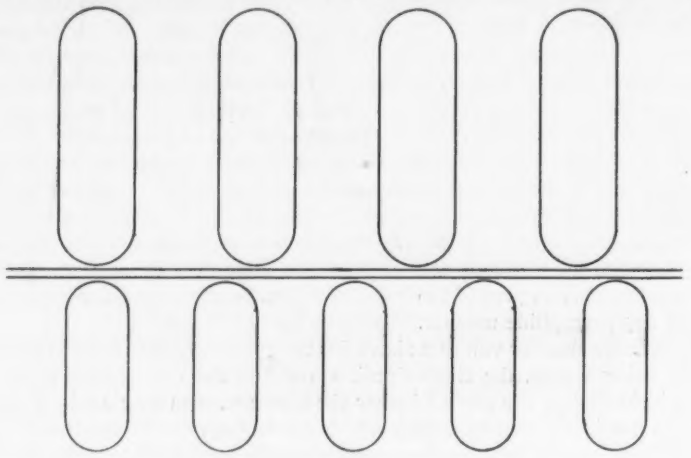


FIG. 12.

the total e. m. f., induced in the 100 conductors by the 5 leakage fields, is proportional to $20 \times 20 \times 5 = 2000$.

Now, let us arrange the 100 conductors in 10 slots. Each slot, then, contains 10 conductors, the leakage field per slot being proportional to 10. The e. m. f. induced by the leakage field in the 10 conductors in each slot is proportional to 10 times 10. Hence the total e. m. f. induced in all the conductors in the 10 slots is proportional to $10 \times 10 \times 10 = 1000$. In other words, the counter e. m. f. of leakage is twice as large in the case of 5 slots as in the case of 10 slots.

The above calculation rests upon the assumption that the reluctance of the leakage path of each slot is the same in the two cases under consideration. Though this is true only with some qualifications, yet

FIG. 13.

the argument clearly shows the superiority of many over few slots, as far as leakage is concerned.

A general rule for the most favorable number of slots can hardly be given. To take more than 5 slots per pole and phase in the field is hardly advisable unless the pole-pitch be very large, as in motors for low frequencies. As the maximum of ampere-conductors per slot 600 might be put down; but this should be no rigid rule. Never take fewer than 3 slots per pole and phase, if possible. If you put too few conductors in a slot, the leakage field is not saturated, and thus the advantage of a great number of slots may be balanced by this greater leakage.

Thus we see that in spite of many rules, still a great deal is left to the individual judgment of the designer.

To enable the reader to form for himself an opinion of the accuracy of the theory, I give the complete experimental data of a small three-phase current motor with short-circuited armature.

The motor shall develop 20 horse-power, at a voltage of 380 between the lines, and a frequency of 47 p. p. s. The slots in armature and field were closed, but the bridges were thin. The shape of the slots in armature and field are represented in Fig. 12. The motor had six poles, therefore its synchronous speed was 940 r. p. m.

The following table shows the starting or short-circuit current as a function of the terminal volts measured between the lines:

Volts	Amperes.	Frequency.	Volts.	Amperes.	Frequency.
82	11	46.7	200	56	46.7
108	20	—	233	70	—
135	30	—	273	90	—
162	40	—	314	112	—

These values are graphically represented in Fig. 13. From this curve we interpolate for 380 volts a current of 140 amperes. The energy dissipated in heat in the windings and in the iron amounted to 30 kilowatts. This point lies upon the broken line curve in Fig. 15, deviating, therefore, not inconsiderably from the full line curve, representing the semi-circle of our diagram. The data determining this circle are given in the following table:

R. p. m. rotor.	Frequency in r. p. m.	Volts.	Amperes.	Watts, Input.	Watts, Output.	Efficiency. η %	Power Factor. $\cos\phi$ %	Apparent Efficiency. $\eta \cos\phi$ %
930	932	380	5.5	2,100	1,300	62	58	36
931	940	382	9	5,400	4,050	75	90.7	68
926	930	380	14.5	9,000	7,300	81	94.4	76.5
910	918	380	20.5	12,900	10,800	84	95.5	80.2
912	925	380	26	15,600	13,200	84.5	91.5	77.3
894	912	380	31	18,600	15,600	84	91	76.5
892	922	380	42	25,100	20,600	82	91	74.5
880	922	380	57	32,400	24,300	75	86.5	65
846	896	382	64.5	35,400	25,500	72	83	59.7
860	940	391	74.5	40,100	26,100	65	79.5	51.7

The curves corresponding to these data, are graphically represented in Fig. 14. The maximum output of the motor is 35 horse-power.

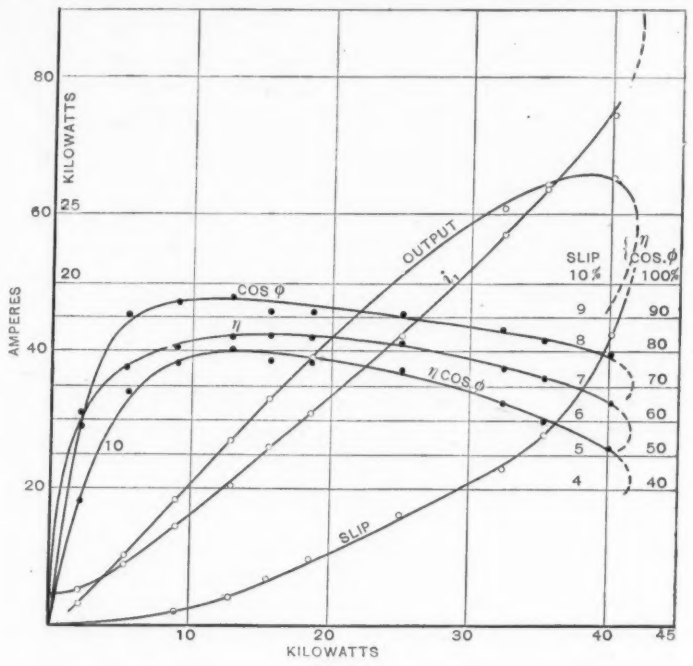


FIG. 14.

This point lies very near the maximum ordinate of the semi-circle in Fig. 15. The diameter of this circle is 122.5 amperes, the magnetizing current 4.5 amperes, hence

$$\sigma = \frac{4.5}{122.5} = 0.0367 .$$

The maximum power factor attainable is, equation (3),

$$\cos\phi_0 = \frac{1}{2\sigma + 1} = 0.93$$

Fig. 15 and the data given above clearly show the inaccuracy which would arise if we were to use the short-circuit current as a means of determining the absolute value of the leakage factor.

I want to call attention to the load losses, which are always present in polyphase motors, the causes of which are, however, still very obscure.

The maximum efficiency of this motor is 84.5 per cent. The losses are:

Hysteresis, eddy currents and friction	800	watts.
Ohmic loss in primary	600	"
Ohmic loss in secondary	200	"
Total losses	1600	watts.
Output	13200	"
Input	14800	watts.

The energy which the motor actually consumed amounted to 15600 watts, corresponding to an additional loss—the load loss—of 6 per cent of the output. The load loss increases rapidly with increasing load, until it becomes equal to all other losses taken together.

Opening the slots has a decided tendency to diminish the load loss considerably, therefore it is probable that the seat of this waste of energy is in the bridges.

It has often been advocated to calculate the leakage fields from the dimensions of the slots, of the air-gap, of the pole-pitch, and so forth; and it has been claimed that great accuracy is thus obtainable. I am not of that opinion. Though I am perfectly aware that it is possible—at least theoretically—to calculate the leakage, yet I cannot close my eyes to the fact that such calculations are, of necessity, based upon

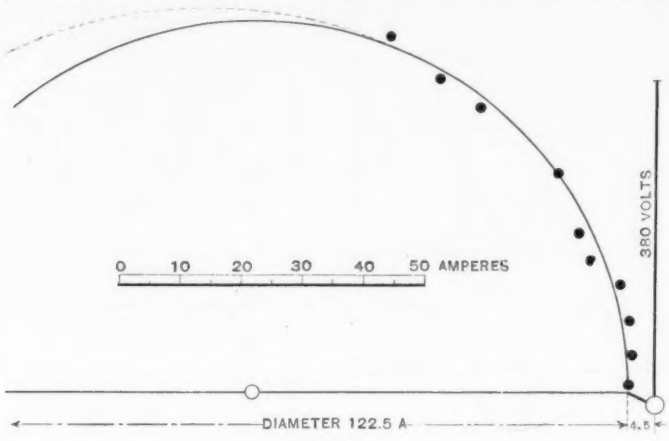


FIG. 15

a good deal of guesswork; the designer who chooses this path is like a man groping in the dark with here and there a guiding light, or, as I should rather say, a will-o'-the-wisp, sometimes guiding him aright, but much oftener leading him astray. I am suspicious of the *a priori* method; it has proved utterly vicious in all departments of human knowledge. Upon a sound experimental foundation any mathematical superstructure may be safely reared; and no desire to obtain a knowledge of things, which are in their very nature not yet clearly understood, should mislead us to build upon the quicksand of imagined data.

The succeeding chapter will be devoted to an exposition of the factors which enter into the equation for the leakage coefficient.

Cars for Negroes.

The New Orleans City Council has defeated the car ordinance providing for the separation of negroes and whites in the street cars. Other Southern cities operated such cars at one time; all have abandoned the system, but three cities have returned to separate street cars in the last few months; and they have operated the new system with a most unsatisfactory result to the public and the car companies. The new system has had the effect of driving the negroes from the cars, thus cutting down the revenues of the companies and, therefore, entailing a less frequent and less satisfactory service for the public. There is further the extreme difficulty of enforcing the law, and it was never enforced in the "star" car days, when white men, in a hurry, paid no attention to it, but insisted on mounting the first car that came along, whether it had or had not a star on it. There is finally, the danger contained in any law which authorizes the conductor to decide whether a man is colored or not. It would thrust a dangerous responsibility upon him, certain to produce serious trouble sooner or later with pronounced brunettes of either sex.

Street Franchises for Electric Circuits.

BY ALTON D. ADAMS.

RIGHT to use city or village streets vests primarily in the general public and is controlled by their representatives, the legislatures of the several States. The law is well settled that towns and cities may exercise only such powers over their streets as are authorized or fairly implied by their charters, or else conferred by legislative enactments. Legislatures in their powers over streets and roads are subject to constitutional provisions and to the easements and property rights of abutting owners. Any or all of the rights of the public in streets may thus be set aside by legislative enactment, without compensation, but the abutting property holder has open to him redress in the form of damages. The original purposes of streets and roads are those of travel, and the interference with this privilege or the use of streets for any special purposes depends on authority derived from the State legislature or from some body to which there has been delegated sufficient powers. Thus it is that no individual or public service corporation may, of right, erect any structures or materials either on, under or over the public streets without authority from a source having power to give it. A right to erect electric wires, poles or conduits in the streets rests on the same foundation as that to lay gas or water pipes or street car lines, that is, legislative authority, either direct or indirect. The interests of electric corporations for public service require careful consideration of the franchises under which they are to operate, especially in the cases where these franchises are not granted directly by legislatures. Charters and franchises granted by legislatures to public service corporations may be revoked by legislative enactment, in many of the States, no matter what the periods fixed in the acts of incorporation for their existence. This power of State legislatures is generally based on reservations in the laws respecting corporations, by which the legislators withhold authority to alter or repeal any charter. An example of State legislation along this line is found in Section 41 of Chapter 68 of the General Statutes of Massachusetts, which reads: "Every act of incorporation passed after the eleventh day of March, in the year one thousand eight hundred and thirty-one, shall be subject to amendment, alteration or repeal, at the pleasure of the legislature." This statute of Masachusetts was upheld by the Supreme Court of the United States in Greenwod vs. Freight Co., 105 U. S., 13. In the case of an exclusive franchise, the legislative power to repeal would obviously include that to amend by granting a similar franchise to another corporation. Franchises granted to corporations, without reservation of authority to amend or repeal by the legislature, cannot be altered after they have been accepted and acted on by the corporations to which they are granted, except for a breach of some of the conditions on their part. This rule was held by the Supreme Court of the United States in New Orleans Gas Co. vs. La. Light Co., 115 U. S., 650, also in earlier opinions. Direct legislative alteration or repeal of the charters or franchises of corporations engaged in electrical supply is not nearly so common as that by towns and cities where they operate, and these latter therefore demand more consideration. The values of franchises granted by towns or cities for the erection of poles, conduits and wires in their streets, as to permanency, are dependent to a material degree on the powers of the town or city to grant franchises, and also on the power to subsequently annul them.

All municipalities have some implied powers over their streets, even where none are expressly granted, and the power to light streets is no doubt one of these. Power to light the streets includes that to erect or cause to be erected the necessary poles, wires and fixtures for the purpose. It does not follow from this, however, that every town or city may rightfully authorize the erection or extension of electric systems in the streets for the supply of private consumers, and such power does not exist in the municipality unless granted by the legislature expressly. Whether, when electric circuits have been set up for street lighting, the supply of private consumers from the same system can be prevented is perhaps an open question, but it has been held that such use does not give legal ground for the removal of the poles and wires. While every city or town has implied if not expressed authority to adopt any suitable means to light its streets, the parties authorized to erect poles and wires for street lighting do not necessarily receive an exclusive or permanent franchise. If a municipality has no express powers on the subject, the privilege to occupy the streets with wires and electric fixtures, granted by it to a corporation or individuals, for purposes of illumination, may be revoked by it at any time. In like manner an exclusive franchise to use electric cir-

cuits in the streets for public lighting, if issued simply on its implied powers by a town or city, does not operate to prevent similar privileges issuing to other parties. The reason for this is that authority to issue exclusive franchises for purposes of street lighting can only be had by a municipality from legislative enactment. In order to determine what powers a town or city has for the issue of franchises to electric systems in its streets, the general law of the State, in which the municipality is located, must be consulted and also its special act of incorporation. If a town or city is authorized by statute to grant a franchise for the erection of electric circuits in its streets, and their use during a term of years, for either public or private lighting, and does grant such a franchise, the town or city cannot subsequently revoke it. A municipality may even grant an exclusive privilege for the erection and operation of electric circuits in its streets, if expressly empowered by the legislature to do so, but this power has been called in question by some courts. The principles stated make it obvious that the erection of electrical distribution systems in public streets, with no authority save that derived from a municipality, may leave the investment subject to the whims or prejudices of its future governing bodies or to the attacks of interested parties. The only safe course, where the franchise for an electric system is granted by a town or city, is to learn just what powers as to the franchise are vested by law in the granting body, and then to move in the matter under only such contracts as insure a fair return in any contingency. A case decided some time since by the Supreme Court of Michigan illustrates some of the above points. In this case a contract was made by the city with certain parties to do public electric lighting during a stated period. Pursuant to the contract permission to erect poles and wires was granted by the common council. After the public lamps were in operation and during the period covered by the contract for city lighting, the electric plant engaged in the supply of private consumers. At the expiration of the period covered by the contract for public lighting the city ordered the removal from the streets of the electric circuits. On final trial in the court named it was held that, as the charter of the city gave it no power to grant a perpetual easement in its streets, the electric system was subject to the pleasure of the city council, after the expiration of the lighting contract, and must be removed at their order.

The Alternating Current Arc—II.

(Concluded.)

By C. Wiler.

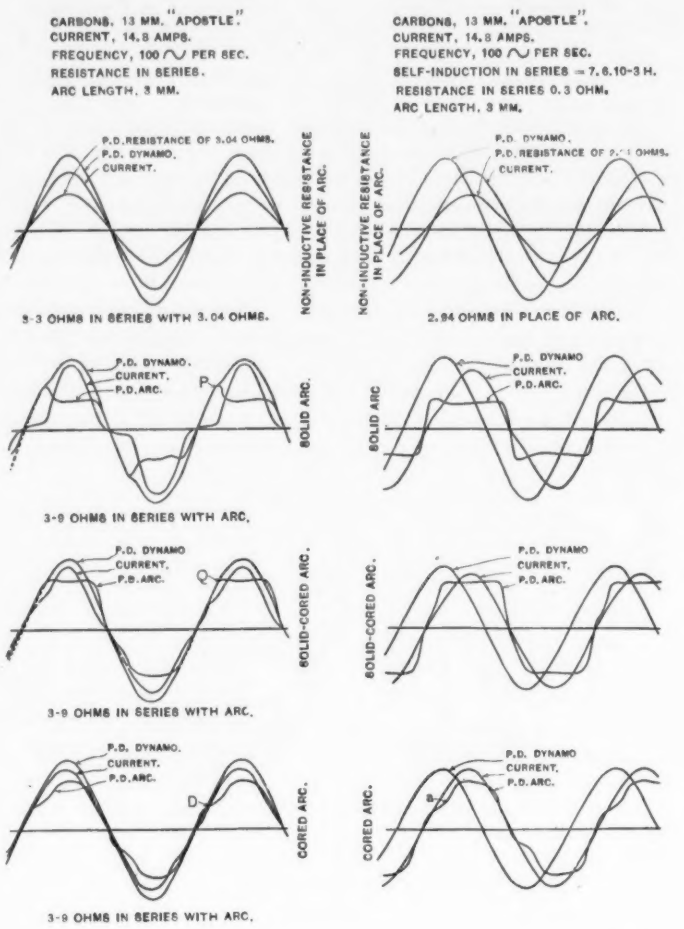
THE study of the alternating arc in the past has been mostly pursued by obtaining the wave forms of the current and e. m. f. through the slow contact method. Of late the more rapid and accurate oscillograph method has been applied by Messrs. Duddell and Marchant, and the results have been communicated to the Institution of Electrical Engineers, London. (*Jour of the Inst. Elec. Engrs.*, Vol. XXVIII., Lond.) An oscillograph is a galvanometer, whose deflections are proportional to the instantaneous value of the current; a mirror attached to the movable part reflects a beam of light upon photographic plates, so that a continuous record of the wave form may be obtained. By employing several instruments the wave form of the current, the wave form of the P. D. of the arc, and of the dynamo, can be traced simultaneously and effect of changes in any of the waves can be recorded and noted. The curves obtained by Duddell and Marchant are undoubtedly the most interesting and accurate known. In Figs. 1 to 10, curves as obtained by them on a 100-cycle alternator with small armature self-induction are referred to.

Fig. 1 shows the wave forms of the P. D. of the dynamo, the current and the P. D. across an ohmic non-inductive resistance of 3.04 ohms in series with 3.3 ohms. Current 14.8 amperes.

In Fig. 2 the energy taken by the resistance of 3.04 ohms has been replaced by an open arc between solid carbons, adjusted for the same current, 14.8 amp. Length of arc, 3 mm. Steadying resistance same as in Fig. 1. Arc voltage, 53.2. Power factor, .74. For the low values of the available voltage at the arc the current hardly begins to rise, so that the P. D. arc wave runs up very abruptly, until it can get the current through the arc, thereupon it decreases again and stays nearly constant until the decrease in current produces a slight rise. The waves of current and the P. D. at the arc appear therefore considerably distorted from Fig. 1. The front peak in the P. D. at the arc wave is very much more pronounced than the back peak, which finds its explanation in the well-known fact, that an alternating current arc is easier to maintain, after the carbons have been heated and their conductivity raised, than in the cold state.

In Fig. 3 the lower carbon has been replaced by a cored carbon. The arc length and the current are kept constant for all experiments on open arcs. The arc voltage is reduced to 37.4; the power factor of the arc increased to .94. The front and back peaks on the P. D. at arc wave have disappeared.

In Fig. 4 top and bottom carbons are cored; arc voltage 32, power factor .99. A comparison with Figs. 1 and 2 shows that the waves



OPEN ARC. OHMIC NON-INDUCTIVE RESISTANCE IN SERIES WITH THE ARC.

FIGS. 1, 2, 3 AND 4.

OPEN ARC. INDUCTIVE RESISTANCE IN SERIES WITH THE ARC.

FIGS. 5, 6, 7 AND 8.

FIG.	CARBONS. TOP.	CARBONS. BOT'M.	RESISTANCE IN SERIES. OHMS.	S. I. IN SERIES. HENRYS.	IMPEDANCE OF INDUCTANCE COIL. OHMS.	P. D. ARC. VOLTS.	POWER. ARC. WATTS.	POWER FACTOR. ARC.	NOTES.
1	3·04 Ohms in place of Arc.		3·3	Very Small.	.....	45·1	666	1·00	To be compared with Fig. 2.
2	Solid.	Solid.	3·3	"	.....	53·2	581	0·74	Slightly Hissing.
3	"	Cored.	3·9	"	.....	37·4	521	0·94	Not Hissing.
4	Cored.	"	3·9	"	.....	32·0	470	0·99	"
5	2·94 Ohms in place of Arc.		0.3	7·6 10-3	4·77	43·4	642	1·00	To be compared with Fig. 6.
6	Solid.	Solid.	0·3	7·6 "	4·94	50·2	635	0·855	Slightly Hissing.
7	"	Cored.	0·3	7·6 "	4·79	37·8	536	0·96	Not Hissing.
8	Cored.	"	0·3	7·6 "	4·80	31·6	461	0·985	"

are not very much distorted and that the arc resistance has undergone a complete change.

In Fig. 5 a non-inductive resistance has been put in place of the arc; in series therewith is an inductive resistance of 4.77 ohms impedance.

Figs. 6, 7 and 8 show the wave forms for an arc of the same length steadied by an inductive resistance; Fig. 6 for solid carbons; Fig. 7 for solid and cored, and Fig. 8 for two cored carbons. The power factor of the arc between solid carbons is considerably higher when

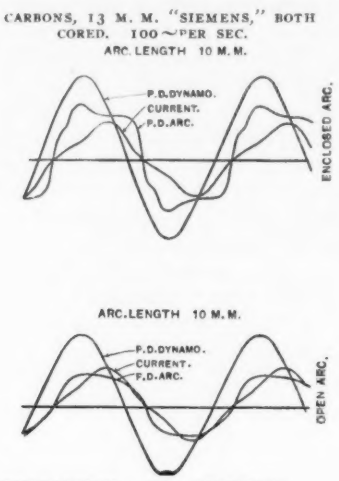
the arc is steadied by the inductive than by the ohmic resistance. The cause therefor has already been referred to.

In Fig. 9 the waves for an enclosed arc between two cored carbons steadied by a choke coil and the regulating magnets are shown. Current, 8.4; arc voltage, 70.5; power factor, .915.

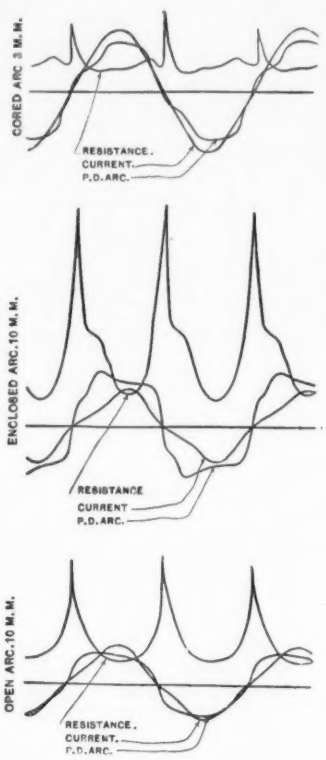
In Fig. 10 the enclosing globe has been removed and the waves have been recorded for the same arc length and current as in Fig. 8. The power factor has increased to .945. The distortion of the waves is therefore greater for an enclosed than for an open arc, and for the latter it increases with the length of the arc.

In Figs. 11, 12 and 13 the writer has plotted the resistance curves of the arc corresponding with Figs. 8, 9 and 10. During a large part of the cycle the resistance of the open arc between cored carbons is of constant value, while the resistance of the enclosed arc varies continuously.

It is now well established and conclusively shown by the curves, that no phase difference is produced by the alternating arc, either open or enclosed, with solid or with cored carbons, although the mere quotient $\frac{\text{watts}}{\text{current} \times \text{voltage}}$ would indicate it. This calculation, however, is only correct for sine wave. Current in the arc and arc voltage cannot be sine waves simultaneously, as shown in the foregoing.



COMPARISON OF ENCLOSED AND OPEN ARC AT CONSTANT ARC LENGTH. CHOKE AND REGULATING COILS IN SERIES WITH THE ARC.



PULSATING RESISTANCE OF THE ALTERNATING ARC, PLOTTED FROM DUDDEL AND MARCHAND OSCILLOGRAPH CURVES.

FIGS. 9 AND 10.

FIGS. 11, 12 AND 13.

The curves in Fig. 9 of the enclosed arc are the only ones ever obtained on an alternator with small armature self-induction, with which the writer is familiar. A further investigation of the enclosed arc by the oscillographic method would be of great interest and perhaps of considerable value. The power factor of an enclosed arc changes with the carbons; it increases with the size of enclosing globe and decreases with the area of the opening left around the carbon in the gas cap. The reasons are self-evident from the foregoing. The more rapid consumption of the carbons by alternating current enclosed arcs, when the arc descends in the inner globe, may also be attributed to the increasing power factor, as it seems that under these conditions the influx of air into the inner globe is facilitated.

FIG.	P. D. ALTERNATOR TERMINALS. VOLTS.	CARBONS. BOTH.	ARC LENGTH. MM.	CURRENT. AMPS.	P. D. BETWEEN TERMINALS OF ARC. VOLTS.	POWER ARC. WATTS.	POWER FACTOR. ARC.
9	100	Cored "Siemens" in Davy enclosed.	10	8·4	70·5	542	0·915
10	82·5	Cored "Siemens" in Hand Lamp.	10	8·5	42·2	338	0·945

A comparison of the resistance curves of the enclosed arc and of the open arc would lead one to expect that the open alternating current arc was the steadier and more peaceful of the two. The open alternating current arc, however, requires for its successful application for commercial lighting high grade carbons and different sizes for changes in current. These two points were, with the decreased luminous efficiency of the open alternating current arc, the humming, the rapid consumption of the carbons, the sensitiveness to atmospheric conditions responsible for the many failures in alternating arc lighting with open arcs. The enclosed alternating current arc cannot very well be used commercially above 7.5 amp., and one size of carbon is therefore sufficient for all conditions. The use of high grade carbons has become universal with the increase in life on account of the use of enclosing globes, and the humming is practically eliminated and a better distribution of the light and greater steadiness is obtained.

The amount of steadying resistance necessary for an alternating current arc is, as explained above, considerably less than for a direct current arc. Recently the Western Electric Company has advocated the use of alternating current arc lamps in series on constant potential circuits with 72 volts at the arc, 6.6 to 7 amp., and only 78 to 80 volts terminal pressure at a frequency of 60 cycles, and with no other regulating device during normal operation than is contained in the lamp. A large number of installations comprising circuits of 3 to 50 W. E. Co. series alternating lamps have shown that alternating arc lamps operated in series direct on the mains or on a constant potential transformer, possess a remarkable stability and an extremely large range for the variation in terminal pressure caused by inductive loads. This feature is of great importance for successful operation of alternating arc lamps on light and power circuits. The present practice of connecting alternating current arc lamps singly on circuits of 104 volts, as required for the incandescent lamps, meets the demand for small installations. The power factor of these lamps is very low (about 65 to 70 per cent), mainly due to the abnormal reduction of the line voltage to the arc voltage. The power factor of the series lamp, on the contrary, is, with a reduction from 78 or 80 volts to 72, very high, averaging about 85 per cent. This great advantage should lead central station men to the consideration of operating alternating arc lamps in series on the mains, or, if insulation of the arc circuits is necessary, they can be connected on constant potential transformers in groups of 3 on 220 to 240 volts, 7 lamps on 500 to 550 volts, or 13 on 1000 to 1050 volts, and so on to as large units as desired.

New Legislation Affecting the Use and Misuse of Electricity.

A very interesting and valuable report has been prepared by Mr. Samuel J. Barrows, Commissioner for the United States of the International Prison Commission on Crimes, Misdemeanors and Penalties in this country, as found embodied in the laws of the Fifty-fifth Congress, and the laws of the various States and Territories for 1897 and 1898. The object of this report is to show the spirit and tendency of modern legislation, and the various legal and ethical distinctions made in different parts of the country in the definition and punishment of crime. The most striking and interesting part of the report, to electricians, is that which deals with legislation bearing on the development of the electrical arts and industries. Mr. Barrows has contributed in his introductory report, a section which deals with this group, and his remarks on the subject are herewith submitted. It may be noted, however, and will naturally be understood that such new legislation has continued down to the present time. Just at present the courts are busy defining the rights and wrongs of automobilism.

When Benjamin Franklin raised his famous kite he was not conscious of raising new ethical or legal problems. His experiment was purely scientific. He meant to draw lightning from the clouds, and he succeeded. At the time there had not been enacted a law like that recently passed by the State of Connecticut, entitled "An act to prevent the stealing of electricity." That electricity might be guided, that it might be measured as easily as water, Franklin may possibly have foreseen. Did he imagine that it would be available for general consumption, that it could be stored as well as distributed, that millions of dollars would be spent in making and buying it, and that eventually electricity would become property?

Franklin's public reputation as an enterprising kite flyer is secure. Wholly different, however, would that reputation be to-day if, instead of flying his kite in the air and waiting for a thunderstorm, he should throw the string over a telephone, telegraph, electric light or electric power wire. If he escaped the physical consequences of contact with a wire carrying heat, light and power the legal consequences in most of the States would rapidly follow any such habitual experiment. In some cities he would come in contact with municipal ordinances forbidding him to fly kites at all in streets trellised with electric wires. The grounding of an electric wire means an "obstruction," or it means a diversion of the current involving an interruption of business or a loss of power. When telegraph wires were first put up in New York the kite nuisance was one of the most common interruptions, and, in crowded cities, a war had to be made upon kite-flying. But electricity as property is exposed not merely to the hazards of weather and to ignorant interference; it is exposed also to theft. It is an easy thing for a skilled operator to tap a wire and steal a message. It is not difficult to divert the current to run a dynamo in your own cellar; and if a man has a grudge against a telephone or a telegraph company he may cut off its business with a pair of nippers.

It was inevitable, therefore, that electricity as property should seek insulation in the statutes of most of the States. Within the last two years a dozen States have had to modify their laws in order to punish "the stealing" of electricity, as it is called in Connecticut, or "larceny," as it is called in Montana, or "malicious obstruction, disturbance, or diversion of the electric current," or "tampering with meters," or interfering with apparatus, which the law recognizes in various other States. It is generally agreed that electrical property must be protected, and all the session laws have become storage batteries for fulminating legal maledictions and contradiction; but the legal doctors do not agree as to what the punishment shall be, and it is here where the contradiction comes in, as it does in every attempt to scale penalties to crimes.

Connecticut, under a law passed in 1897, punishes the stealing of electricity by a fine not exceeding $50, or by imprisonment in the county jail, which may last ninety days. Montana punishes such "larceny" by a fine of from $100 to $500, equal to the penalty for the larceny of gas or water. In Michigan the penalty is $100 and costs, or imprisonment not exceeding three months, or both fine and imprisonment. Maryland, New Jersey and Iowa have the same penalties—a fine not exceeding $500, or imprisonment of not over six months, or both. Georgia makes the offense a misdemeanor, the punishment for which may be a fine of not more than $1,000, imprisonment not exceeding six months, or work on the chain gang twelve months. The same variation will be found in other States. Though there are meters for water, gas and electricity, there is no pœnometer by which to measure penalties. If such a meter could be invented and introduced into legislatures and courts of justice we might hope for some uniformity in gauging penalties for crime.

Granted that Franklin may have foreseen that it would be a sin to steal electricity, could he have foreseen that it would be a sin punishable by fine or imprisonment to give it away? Yet the people of Nebraska have lately passed a law in which the giving away of electricity to certain persons is prohibited. Telephone and electric light companies are forbidden to give free or reduced rates to any city or village officials, and the officers or agents of a telephone company bestowing their favors in this way are liable to a fine of $100 to $500 and to imprisonment of from thirty days to six months. Electric light companies committing the same offense are liable to the same fine, and the guilty persons in such corporations may be imprisoned for from thirty to ninety days.

Why telephone officials should be imprisoned for six months and why electric light officials should get off with a maximum of ninety days does not appear in the statute. Passed in order to prevent unjust discriminations, a distinction is nevertheless made in the penalty where no difference is apparent. On the other hand, the penalty for the city official who accepts free or reduced telephone or electric light or water service is a fine of from $100 to $500 and imprisonment from thirty to ninety days, with forfeiture of office. The same penalty is provided for city officials accepting free passes on street railways. A laudable attempt has here been made to make the penalties uniform. The Nebraska law is an intimation that electric light, power and traction companies may become a source of bribery and corruption in municipal affairs, and that it may be even necessary to prohibit city officials from using water freely.

Thus the introduction of every new invention may enlarge the field of litigation. There is, first, an opportunity, unknown to the ancients, to quarrel about patents, which constitute a special law branch turning mainly upon questions of priority. That, however, relates to the birth of the invention; carrying it into court, but not into the legislature. The lawmakers are concerned, not with its genesis, but with its effect, and with the form of public injury into which it may be perverted. It is curiously interesting to note the way in which, sooner or later, new inventions are engraved in the criminal code. Not even the most utilitarian moralist would venture to suggest that there is anything wicked or maleficent in electricity or in any of the forces of nature. These are rather beneficent gifts for which we are grateful; but their application to modern life opens new sources of temptation or reveals new sources of danger.

A host of modern inventions or manufactured articles having a market value constitute a new opportunity for the thief. Most of these articles come under the ordinary definitions and conceptions of property. They do not need to be catalogued in the statutes. The theft of a lamp is larceny; it may be a Roman lamp or a Greek lamp, an oil lamp or an electric lamp. Whether it constitutes grand larceny or petit larceny will in certain States of the Union depend, not upon its age or newness, but upon its market value. On the other hand, there are a great number of modern crimes which could not have been committed in ancient days because the instruments for their perpetration did not exist. They are the outcome of modern civilization and they require new legislation.

The tapping of a telegraph wire is a modern form of highway robbery. In the old days, the method was to waylay the courier on the road and to rob him of his purse or of his message. The formula of the modern highwayman is not, "Stand and deliver," but simply "Deliver." And he may get a message from the lightning courier which may be worth more to him than a well-filled purse. But there is nothing to be gained by indiscriminate tapping. It is some special message or information that the thief is looking for, possibly for its effect on the stock market or on other business ventures; but the use of cipher codes renders the tapping of telegraph wires of little avail even in time of war, unless the code, as well as the message, has been stolen. For the tapping of power or light lines the modern highwayman comes in out of the rain. He can do his business better indoors by attacking the electric meter, confusing its calculations, and thus getting more current than he pays for. Such at least seems to be the implication of recent statutes.

If, however, electricity permits itself to be used as an agent of crime, it is also invoked to prevent crime. The housebreaker must beware of the burglar alarm, and the flooding of stores at night by electricity is a brilliant defiance to his dark lantern. The telephone and the telegraph may assist in capturing the criminal, and the electric light may illumine his cell and his intellect. The motive for introducing the electric light in the Kentucky penitentiary at Frankfort is thus declared in the statutes of 1898, "that inmates may have an opportunity to study at night."

In adopting execution by electricity Massachusetts followed in the wake of New York. It is more merciful than hanging, and more rapid. It can be done in a cell with a few witnesses, instead of with theatrical effect in the rotunda of the jail or in the jail yard with several hundred spectators. In civilized communities, if the death penalty persists, the electric current will no doubt displace the rope and the ax. But Colorado recently cut the hangman's knot in another fashion by abolishing capital punishment altogether.

In modern legislation steam has had an enormous influence, especially in the way of railroad legislation. The introduction of electric railways now renders necessary many verbal amendments in the laws of the States. Penalties have long been enacted for obstructing steam railroads. Where the word "steam" was used in the statutes the phrase "steam or electricity" is now necessary. So, in recent statutes, there will be found many laws for the protection of street railways and for punishing intereference with electric motors, just as interference with locomotive engines is punished. Electricity has even made itself felt in the game laws, in many of the States the use of electric launches as well as steam launches being prohibited in duck shooting.

Election Returns.

The Chicago *Record* announced election returns with the aid of a big General Electric search-light placed on the top of the Masonic Temple, the highest office building in Chicago. The rays of this light could be seen many miles. The Chicago Telephone Company had a well-planned service for announcing election returns to those subscribers desiring it.

Lighting and Power in a Washington Hotel.

The Raleigh Hotel, Washington, ranks among the finest and most handsomely equipped hotels in the United States. Occupying a prominent position on Pennsylvania Avenue and Twelfth Street, the illuminated sign, "The Raleigh," with its 500 incandescent lamps, as well as the handsome architecture of the building, engage the attention of visitors arriving at the adjacent railway depots. The popularity of this hotel decided the management to construct a new wing upon Twelfth Street with eleven stories, to be entirely fireproof. Designs for the addition were prepared by the consulting and constructing engineer of the hotel company, who is also superintendent of the Congressional Library, to which is due the credit for the great success that has attended the installation of the electrical and mechanical equipment. When the changes were made, the old belt-driven generators were discarded for those of newer type, and the new plant was placed in a vault which extends under the sidewalk of Twelfth Street, which was specially excavated for the purpose. This vault extends for a length of 88½ ft., with a width of 19 ft. for a distance of 21 ft., narrowing down to 14 ft. wide for the remaining distance. The height of the ceiling varies with the street grade, but has an average of 9 ft. The roof of the vault consists of brick arches sprung from I beams, over which is a layer of cement concrete upon which rests the granolific pavement, with a layer of tar and tarred paper between. The advantage of placing the power plant in this vault has been very apparent during the months since it was put into operation. Being perfectly insulated from the iron framework of the building, no noise or vibration is transmitted. The utilization of this space, which would otherwise have been vacant, leaves the entire basement for other purposes.

The electrical equipment was designed and erected by the Westinghouse Electric Manufacturing Company. The new plant supplies light and power for the older portion of the hotel as well as for the new wing. The boiler room is in the rear of the new addition, its floor being about 6 ft. below the basement. Two Geary boilers of 204 horse-power each with a working pressure of 120 pounds, supply steam through an 8-in. main to the engines in the power room. Steam mains and other steam pipes are protected with asbestos air-cell nonconducting material. In the widest part of the power room are placed side by side two 100-kw Westinghouse direct current generators, 125 volts, direct connected to two Harrisburg standard tandem compound engines, running non-condensing at a speed of 275 r. p. m. Beyond these two units are placed two others, a 75-kw generator and a 25-kw

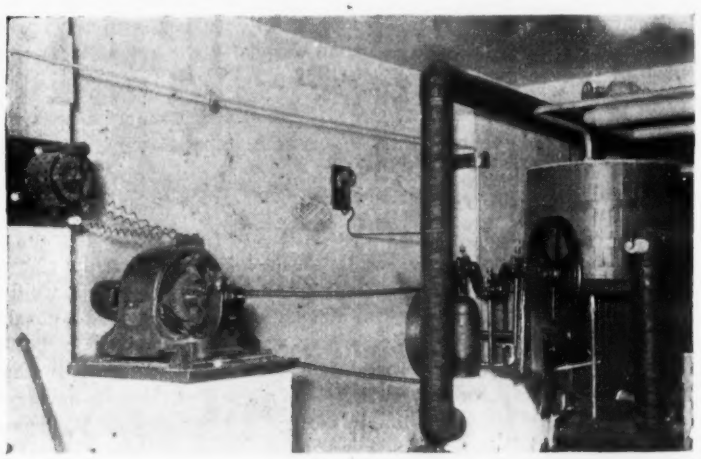


FIG. 1.—BRINE CIRCULATING PUMP, DRIVEN BY 7½-HP MOTOR.

generator, both engine type, 125 volts, direct connected to Harrisburg simple engines, the former having a speed of 290 r. p. m. and the latter 320 r. p. m.

The four generating units, aggregating 300 kilowatts, have been designed to provide for an economical use of power, and a relay system which can be readily operated in case of temporary stoppage of any unit. The generators have frequently been overloaded from 25 per cent to 45 per cent, but have carried the overload very successfully. On account of the lack of head room in the vault, the field castings of the generators are divided vertically and set upon guide plates. This vertical division of the field affords facility for inspection or removal of armature or field coil, without disturbing the outboard bearing or dismantling the engine. As no cranes are available in this vault, the horizontal opening of the field has proved to be a great convenience.

The hotel is wired for about 4000 incandescent lamps. Exquisite and artistic effects have been arranged in the parlors, café and writing rooms, by grouping a number of incandescent lamps of variegated colors. The marble walls reflect the light from the chandeliers and cornices, shedding a soft but brilliant light throughout. Current is taken direct from the switchboard for the 110-volt lamps. In addition

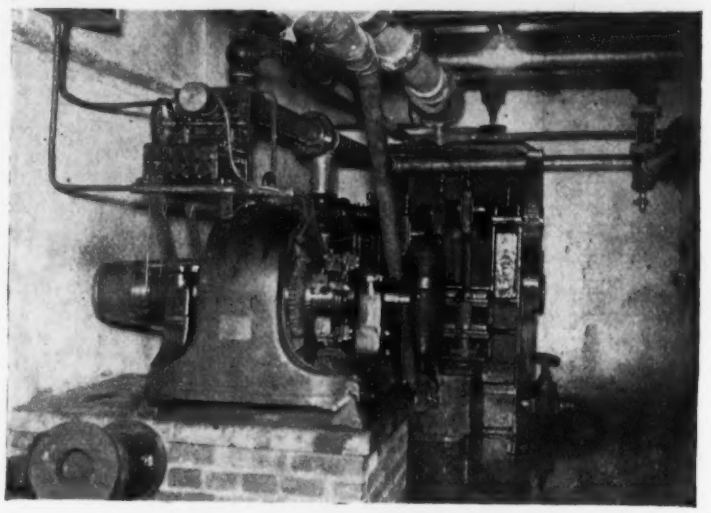


FIG. 2.—TRIPLEX PUMP, DRIVEN BY 10-HP MOTOR.

to the lighting circuits, power is supplied for several electric motors in different parts of the building, aggregating a total of 60 horse-power. As the places where power was required for operating the pumps and other apparatus were widely scattered, it was impossible to use steam with any degree of economy, and the introduction of electric motors has been attended with the greatest success. The motors, which are of the standard Westinghouse direct-current type, require very little attention, performing their work efficiently and win universal praise.

The ice plant, which has a capacity of 10 tons in 24 hours, is the largest user of power, as it employs three motors. Next to the fourth generating unit in the sidewalk vault, are placed side by side and longi-

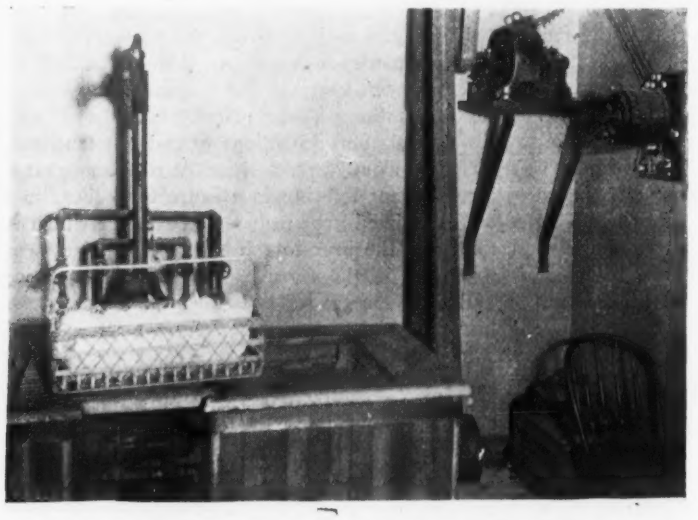


FIG. 3.—DISH WASHER, OPERATED BY 1-HP MOTOR.

tudinally with the vault, two elevator pumps 14 x 20 x 12 x 28. A 20-hp motor running at a speed of 600 r. p. m. operates the ammonia pump. The motor was formerly connected by gears, but it was considered expedient under existing conditions to substitute an "L. P. & D." transmitter for the gears. The water for cooling the condensing coils is taken from a 3-in. artesian well by a No. 12 Gould Challenge pump operated by a 2-hp motor, belted as shown. A Gould 5 x 8 triplex pump is belted to a 7½-hp Westinghouse motor with a speed of 950 r. p. m., for pumping brine for the ice plant. A view of this is shown in Fig. 1.

Water for the hotel is taken from the city mains. It flows through a battery of three Loomis-Manning filters, which have a daily ca-

pacity of 125,000 gallons, and passes into a large iron tank in the basement. From this tank the water is forced to another tank upon the roof, 160 ft. above the basement, by a Gould 6 x 8 triplex pump operated by a 110-volt 10-hp multipolar motor, shown in Fig. 2. This pump is also connected to the fire lines in the hotel, and can be used for extinguishing a fire before the city department could respond to an alarm. The motor is operated automatically, for whenever the water in the tank on the roof falls 2½ ft. below the normal level, a float connected with a Western Electric automatic switch causes the closing of the switch, which reopens and cuts out again when the water reaches the capacity of the tank. A 2-hp motor operates a Gould triplex pump for removing drainage from the basement and pumping it into the sewer. The drainage from the basement is collected in a well and pumped therefrom to the city sewer. This motor is also started and stopped by an automatic device similar to the one described above for pumping the house water. A dumbwaiter running from the kitchen to the eleventh story is operated by a 7-hp motor. There are several ventilating fans, motor driven; and to alleviate the summer heat there are a large number of electric fans distributed throughout the hotel. One of the illustrations show one of the smaller motors, a 1 horse-power, operating a dish-washer in the scullery. Each room in the hotel is equipped with a teleseme. These instruments when first erected were operated by a battery of 20 cells, but the cells were exhausted so rapidly that they were discarded for the more reliable current supplied by a small motor generator. This electrical machine stands near the switchboard where it can be seen at all times by the attendant. Its incoming current is 110 volts and 2½ amperes, the outgoing current is 16 volts and 10 amperes.

Some Data as to Central Station Costs.

Prof. W. D. Marks, president of the City Heat & Light Company, of Fostoria, Ohio, has recently addressed to a committee of the City Council an open letter on the subject of municipal ownership, in which he presents some interesting data. We abstract and reprint part of it, as follows:

When I tell you that in the great and prosperous State of New York three-fourths of the electric lighting companies have never paid a dividend, when in addition to this I can assure you that the city of Toledo, with its marvelous increase of population, has never had in it an electric lighting company which has paid a dividend, you will begin to realize what has been most vividly borne in upon the writer, that is the fact that neither the capitalists nor the managers of most of the electric lighting companies now in operation, and which they assume to manage, have ever grasped the commercial conditions which should control the fixation of their prices. Had they done so, instead of the story of speculation, consolidation and constant loss to which I have referred there would have perhaps been a somewhat less general spread of incandescent lighting in all directions, but, on the other hand, a greater specialized growth in directions for which it is pre-eminently adapted, and the investors in these enterprises would have received a fair profit, in the form of dividends upon moneys which may now practically be regarded as lost.

The disastrous history of municipal attempts at electric lighting also largely results from the facts already referred to, and the fact "that no man can serve two masters." The managing political body, if it consists of men desiring votes, will not adhere closely enough to the immutable financial conditions of the undertaking to bring about pecuniary success. The history of attempts of municipalities is about as follows: By means of a general tax levy on the whole community, sufficient funds are obtained to erect an electric lighting station. On the assumption that no profit need be made, the prices of electric light are fixed somewhat lower than those charged by neighboring private corporations furnishing electric light, regardless of the fact that the corporations may have found themselves unable to make money or expand their business. The works are started, and for the first year or two the bookkeeper reports "a profit." What this bookkeeper means is that the amount of money received from consumers of electric light exceeds the amount of money paid for coal, lubricating oil, waste, lamps and the services of engineers, electricians, linemen and other attendants. The bookkeeper has overlooked the serious item of deterioration of plant and of interest on the money invested, so, after a few years, the municipality is asked for another appropriation for "extension of plant." Such a thing as deterioration is never mentioned, and all question of profit is waived. This manœuvre is repeated once or twice, and then it begins to dawn upon the hitherto benighted brain of the tax-payers, using candles, oil or gas, that those using the electric lights are enjoying a luxury for which they (the taxpayers) are paying, and the works are sold at a loss, and the price of electricity rises. In the course of our oral interview you emphatically rejected all idea of a scale of charges based upon the expenditures of this company for its new works, and so I will not take the figures which might be drawn from the books, but make use of such figures as I have obtained from an experience of nearly a score of years in the operation and construction of electric lighting stations and machinery throughout the United States. In the case of economically but well-built incandescent electric lighting stations, I have found that their cost ranges between $200 and $250 per horse-power, when complete in all particulars and ready to run. We can take an average of $225 as covering the cost per horse-power of charter, legal services, solicitors, real estate, buildings, boilers, pumps, injectors, steam piping, engines, belting, dynamos, measuring instruments, switchboards, lines of wire, poles, insulators, converters, underground conductors, meters, office furniture, taxes during erection, plans, drawings, salaries of engineers and experts, labor of men erecting lines, etc. After what I have told you of the ill success of capitalists and managers having their money invested in electric lighting and pretending to manage their business, it is not at all strange that others, who perhaps have never entered an electric station should have formed views so erroneous as to render it almost impossible for them to understand the conditions upon which electric lights can be furnished at a profit, or, at least, without a sure ultimate loss.

I shall crave your closest possible attention while I next take up the actual figures of the cost of production of incandescent electric light. I have already told you that the average cost of electric stations per horse-power is $225. A moment's reflection will convince you that the machinery and plant used for the production of electric lights is peculiarly subject to deterioration, and you will agree with me that placing the annual deterioration at 10 per cent is a low rating, since with the rapid progress of electrical science any machinery not worn out will have to be replaced within 10 years in order to keep abreast of the state of the art. You will thus see that the sum of $22.50 must be set apart each year for each horse-power installed. In the case of this company, the fixed annual expense for office rent, taxes, salaries of clerks and managers, stationery, etc., amounts to $3,500. The number of lights attached is about 1250, so, if we take $1,750 (one-half of $3,500) as the annual cost of supervision, of office expense, of reading meters, and of the thousand and one services which must be rendered our consumers, in our electrical department, each lamp costs for its care $1.40 a year. Theoretically, 15 16-cp lamps should be operated to the horse-power; practically 12 lamps to the horse-power, after the losses are deducted, is nearly the actual fact; thus we have:

For annual depreciation	$22.50 per horse-power
For annual fixed expense	16.80 per horse-power
Total	$39.30

We have not yet taken up the question of profit on the investment, per horse-power, nor the cost of the operations producing the electric current. Dividing $39.30 by 365 days, and again by 12 lamps, we find that each lamp attached is costing the station 9-10ths of a cent per day while it only stands and waits in darkness to be used. We should, however, allow to the investors in electric lighting enterprises a fair profit on their investment (such as we allow to others in business) as their rights. If we can obtain money at 4 per cent on bonds and mortgages, which have no risk whatever attendant upon them, we surely ought to allow to the average business man a profit of 8 per cent, and 8 per cent of $225 is $18. Adding this to $39.30, and dividing the resulting $57.30 by 365 days and by 12 lamps, we obtain 1.3 cents as the price per day which should be paid for lamps which stand and await the consumer's convenience without being lit, provided the consumer is wise enough and generous enough to allow his neighbor, who serves him, an honest and moderate profit for his services.

Having led you to this point (as I hope, logically, and with your full concurrence), you will begin to wonder how any one can afford to do any incandescent lighting at all. It is right here that the saving condition allowing the existence of electric lighting enters in. The writer has found by experiments conducted on an enormous scale, using many thousand lamps attached at once, for a period of a year that it costs but 14-100ths of a cent (about 1-7th of a cent) to furnish the current to light a 16-cp for one hour. This is about the same as 3

cents per kilowatt-hour for coal, lubricating oil, waste, lamps and service of engineers, oilers, firemen, linemen, inspectors, etc., required in manufacturing the electric current. To put this in another way, for 1 cent the current required to keep a 16-cp electric lamp alight for 7 hours can be produced. It can be said, also, with commercial accuracy, that this 1 cent will keep 2 8-cp lamps alight for 7 hours, or 4 4-cp lamps alight for the same length of time. It is a remarkable fact that on the continent of Europe, where incandescent electric lighting has had the combined consideration of artisan and artist, the 8 candle-power is the standard of illumination, producing the best and most artistic effect, when used in larger number, but not twice as often, as the 16-cp lamp is used on this side of the Atlantic.

Perhaps it would be simpler to ask 1 11-100 cents per lamp per day for all lamps put in, and merely reading the meter at stated intervals, to add for each lamp per hour 14.100 of a cent (about 1-7 of a cent). Your reply to this, at once, is: "We do not use all of our lamps at once. We use only half of them, or a quarter of them, and consequently you are not obliged to invest $225 in machinery, plant, etc., every time we put in 12 lamps." My answer to this is: "Your statement is right, 51 weeks out of the 52 in the year, or perhaps even 364 days out of the 365 in the year." How about Christmas Eve?—how about the week before Christmas? Are not all lights burning then? We cannot store electricity as we do gas, and our machinery is not light or portable. It must be there the whole year, ready to meet your uttermost needs, and if you use it but one day in the year, our money must be invested the whole year. Again I must ask your most careful scrutiny of the tabulated results of my figures, which are subjoined. You will see that if electricity is used more than 3 hours it can be sold at a profit, and still be cheaper than gas at $1 per 1000, and if it is used for 10 hours it can be sold at the same price as illuminating gas at 50 cents per 1000, and leave a profit to the producer. I will say, for your information, that 200 lamp-hours of a 16-cp lamp furnishes the same amount of illumination as 1000 cubic feet of a 16-cp gas. Beginning with 1 11-100 cents, we have the following for 4 per cent profit:

TABULATION.

Price for 1 hour per day...1.25 cents	Price per hour 1¼ cents..per 16-c lamp
Price for 2 hours per day...1.39 cents	Price per hour .69 cent...per 16-c lamp
Price for 3 hours per day...1.53 cents	Price per hour .51 cent...per 16-c lamp
Price for 4 hours per day...1.67 cents	Price per hour .42 cent...per 16-c lamp
Price for 5 hours per day...1.81 cents	Price per hour .36 cent...per 16-c lamp
Price for 6 hours per day...1.95 cents	Price per hour .32 cent...per 16-c lamp
Price for 7 hours per day...2.09 cents	Price per hour .29 cent...per 16-c lamp
Price for 8 hours per day...2.23 cents	Price per hour .28 cent...per 16-c lamp
Price for 9 hours per day...2.37 cents	Price per hour .26 cent...per 16-c lamp
Price for 10 hours per day...2.51 cents	Price per hour .25 cent...per 16-c lamp
Price for 11 hours per day...2.65 cents	Price per hour .24 cent...per 16-c lamp
Price for 12 hours per day...2.79 cents	Price per hour .23 cent...per 16-c lamp

COPY FOR BOOKKEEPER, METER RATES.

1	hour per day	1¼	cents per	L. H.
1¾	hours per day	1.03	cents per	L. H.
1½	hours per day	.88	cent per	L. H.
1¾	hours per day	.77	cent per	L. H.
2	hours per day	.69	cent per	L. H.
2¼	hours per day	.63	cent per	L. H.
2½	hours per day	.58	cent per	L. H.
2¾	hours per day	.54	cent per	L. H.
3	hours per day	.51	cent per	L. H.
3¼	hours per day	.48	cent per	L. H.
3½	hours per day	.45	cent per	L. H.
3¾	hours per day	.43	cent per	L. H.
4	hours per day	.42	cent per	L. H.
4¼	hours per day	.40	cent per	L. H.
4½	hours per day	.39	cent per	L. H.
4¾	hours per day	.37	cent per	L. H.
5	hours per day	.36	cent per	L. H.

CURRENT NEWS AND NOTES.

WIRELESS TELEGRAPHY.—The French War Department has decided to devote $80,000 to secret experiments with wireless telegraphy with a view to perfecting its campaign applications.

RUSSIAN TELEPHONY.—A cable dispatch from St. Petersburg of Nov. 3 says: The telephone systems of the Russian cities, hitherto operated by the State, will be sold at auction on Nov. 20. It is understood that the St. Petersburg municipal government will bid for the local franchise.

THE PARIS UNDERGROUND.—A cable despatch from Paris of Nov. 10 says: The first accidental electrocution in France happened to-day. A underground train jumped the track. In the panic following a passenger climbed out and, despite the shouted warnings, stepped on the third rail. He was killed instantly.

NEW YORK ELECTRICAL SOCIETY.—The 209th meeting of the society will be held at the College of the City of New York, Twenty-third Street and Lexington Avenue, on Friday, Nov. 16, at 8 p. m. Mr. C. P. Steinmetz will lecture on "Alternating Current Engineering." The subject will be treated from the practical standpoint, and the lecture will furnish a complete survey of the tendency of the time in the whole field of electric light, power and railway work.

CABLES IN ALASKA.—The steamship Ohio, which recently arrived at San Francisco, brought the news that telegraphic communication had been established between Nome and St. Michaels, the first message having been transmitted just before the steamer sailed. The Alaska Commercial Company laid a temporary cable, 120 miles in length, using the sidewheel steamer Sadie as a cable ship. The rate is $2 for ten words. The new line will be of inestimable value to business in Northern Alaska, pending the completion of the United States Government cable, which was delayed by the wrecking of the steamship Orizaba. The wreck has been sold for $1,250. It is reported that the telegraph line from Skagway down the Yukon to Dawson will not be opened this winter, though nearly completed.

MANHATTAN SUBWAY CONCESSION.—The fate of the application of the Manhattan Elevated Railway Company for a permit to lay conduits of its own to carry the electric current from its power house on the east side to its west side lines will probably be decided in a few days. The right to lay subways is an exclusive franchise in the hands of the Consolidated Telegraph & Electrical Subway Company. The surface railway companies have subways of their own, and the Manhattan Elevated Railway Company believes it ought to have the same right as the surface companies. Commissioner Kearney, of the department of public buildings, however, doubted his right to grant such a permit, and asked the corporation counsel for an opinion. Assistant Corporation Counsel Connolly has submitted an opinion for approval to Mr. Whalen, who is now considering it, and will make his decision known within a day or two. If the permit is refused, the Manhattan Elevated will have to pay a large rental to the subway company in order to transmit its power to the Ninth and Sixth Avenue lines.

STORAGE BATTERY PLATES.—Mr. Henri Weymersch, of Paris, France, has patented in the United States a new method of increasing the life and capacity of storage battery plates. He adds to the acidulated water as generally used for mixing the oxides and fixing the same to the metallic frames a certain quantity of pyridin (C_5H_5N) or any of the salts belonging to the same group, the plates when dry being dipped alternately in a bath of acidulated water (say sulphuric or hydrochloric acid) and in a mixed solution of pyridin-water and alcohol. This combination of pyridin with acid and alcohol has the effect of highly oxidizing the plates carrying the positive terminals, so as to greatly increase their electrical capacity, and the further effect of hardening the said positive plates to an extent which renders the buckling of the plates and the disintegration of the same almost impossible even at heavy electrical discharges. Accumulators made as thus described not only last very much longer than the ordinary accumulator constructed on the Faure system, but are capable of yielding more than 20 amp.-hours per kilogram of plate or 9 amp.-hours per pound.

AUTOMOBILE FETE IN PARIS.—A cable despatch notes that one of the most successful fêtes of the Exposition was the automobile parade on No. 8, organized by the Automobile Club of France. Three separate processions of motor carriages, each decorated with flowers and preceded by detachments of cavalry, circulated in various directions throughout the Exposition grounds. The only avowed American automobile, however, was a little 3-hp voiturette belonging to Mr. James Gordon Bennett. It was covered with yellow and brown crysanthemums, those being Mr. Bennett's racing colors, and received a gold enamelled medal. One feature in the parade was a Jeantaud electric cab, covered with yellow blossoms, with the driver perched behind, tout à fait after the style of a hansom. The firms De Dion et Bouton, Panhard et Levassor, Krieger, Sarrazin, Peugeot, Jeantaud, Ravenez, the Cleveland Machine Company (Sperry), Lenzeler, Chap-

elle et Chevallier, De la Laye & Co., Bardou and Corre were all represented, each sending several carriages. The automobile parade attracted 339,580 visitors to the fair, but during the procession five entrance tickets were required for each person. The number of tickets used during the day was 1,238,891, breaking the records.

GOOD ROADS.—Martin Dodge, director of the Office of Road Inquiry of the Department of Agriculture, and W. H. Moore, president of the Interstate Good Roads and Improvement Association, have arrived in Chicago after an extended tour of the West in the interests of good roads and other internal improvements. They will complete the arrangements for the National Good Roads and Irrigation Congress, to be held in Chicago from Nov. 19 to 24. Delegations will attend the congress from all parts of the United States. The discussion will take up the construction of good roads to bring farmers and city people in closer contact with each other, and the dredging of streams and the extension and improvement of irrigation work throughout the country. A national committee representing every State will be appointed to present the subject to Congress, so that appropriations may be made to carry on the work. Bills will be prepared for introduction into every State Legislature, so that uniform State legislation in regard to internal improvements may be arranged. Director Dodge and Mr. Moore are well pleased at the success of their Western tour. They covered more than 17,000 miles, visiting all the principal Western cities, and held good roads conventions in Topeka, Omaha, Sioux Falls, Boisé City, Spokane, Seattle, Tacoma, San Francisco, Los Angeles and Denver, and formed State and district organizations of the Interstate Good Roads and Improvement Association in each of those cities.

MARCONI AT WORK.—A cable dispatch from London of Nov. 5 says: Wireless telegrams were sent with success from the Belgian packet steamer Princess Clementine, while nearing Dover Pier, to Ostend, across nearly 50 miles of sea. Marconi's instrument sent messages to and from Belgium with congratulations to King Leopold. The only connection between ship and shore was a wire hoop at the topmast. The land instrument was at La Panne, on the Franco-Belgian frontier, 30 miles from Ostend. Frequent messages were sent to and fro at the rate of 20 words a minute until Dover, which is 61 miles distant, was reached. A later dispatch states that trials of the Marconi system were witnessed by the Belgian Government officials while the same steamer was on her voyage on Nov. 8. The crowning achievement of all, the later dispatch adds, was when a message was sent from the Princess Clementine to Mr. Marconi's wireless station at Dovercourt, Essex, a distance of 80 or 90 miles. Long messages were also sent from Dover Pier to Mr. Marconi's office in London, via Dovercourt and Chelmsford. The Belgian authorities are so satisfied with the results of the wireless system that it will shortly be put up on other vessels in the fleet. It is stated that both the Northern of France Railway Company and the English railway companies are anxious to have an installation on the Dover-Calais boats, but the objections of the English Government prevent this being done at present.

ELECTRIC MACHINE TOOLS.—In working large pieces in a lathe much time may be lost in change of speed at the point on which the tool is working as it moves inwardly toward or outwardly from the centre, since if the tool cuts rapidly on outer parts of the work it must cut very slowly when it gets near the centre, as the circle over which it travels is of much less diameter, and if changeable gearing is provided for effecting a change of speed considerable time is lost in adjusting the machine. On the other hand, if a hand rheostat is used constant attention of the operator is required. In large boring and turning mills this is particularly evident where the cutting tool may have a range of motion of 10 or 15 ft. Obviously unless means are provided for changing the relative rate of travel of the tool and the work a very slow rate of cutting will be effected on the central parts of the work. Mr. John Riddell, of Schenectady, N. Y., has taken out a patent on a plan to automatically adjust the conditions so that the tool may be given a continuous and uniform rate of travel with relation to the work. He effects this result by driving the machine by an electric motor and automatically changing the motor connections as the cutting tool travels over the work, so that a uniform rate of cutting will be maintained on all parts of the work. This invention is applicable to all types of tools in which a relative rotation of the tool and work is effected—such as lathes, boring and turning mills, etc.—means being provided for automatically increasing the speed of the motor as the cutting proceeds from the centre outward, and *vice versa*. A drawing is shown in the patent of a cutter head, on which is mounted a contact device which as it moves to and fro with relation to the work changes automatically the voltage on the field and armature of the driving motor, either or both, to maintain a uniform cutting rate.

SUBMARINE BOATS.—In his annual report, Admiral Hichborn, chief of the Bureau of Construction of the Navy Department, says in regard to the "Holland" boat: "The past year has brought to fruition the experimental work covering a considerable period and has demonstrated the practicability of the submarine boat. The vessel which the department recently acquired has shown herself capable of such perfect control in the vertical plane that she may be kept within a few inches of any desired depth while moving or brought to the surface and taken under again in a very short time; her direction and control in the horizontal plane on the surface is effected with the same facility as any other craft, and submerged is limited only by the difficulties of vision; her crew is provided for on board with reasonable comfort and perfect safety for such periods as she may be in service, and working either upon the surface or submerged; and her armament, consisting entirely of torpedoes, gives her great offensive power. In spite of the unsuitableness of the forms of power generators at present available for a vessel running both on the surface and submerged, there is attained, under both conditions, a speed which, while not all that is desirable, will make the vessel capable of efficient service as an element for coast defense. Of the possibilities in the application of efficient submarine vessels to coast defense work it is not necessary to speak; nor is it necessary to do more than mention the economy of men and money in this form of defensive preparation and the moral effect upon an enemy which will come from a knowledge that we possess and are employing for coast and harbor defense vessels of so great possibilities. At least one European nation having a considerable coast line to defend has entered seriously upon the construction of submarine vessels, and has in hand, or projected, a considerable number of this class of vessel."

CONTROLLING END PLAY OF ELECTRICAL MACHINES.—A patent issued Nov. 6 to Edward M. Hewlett describes a method of controlling end play of a revolving shaft to conform to the natural period of oscillation of the shaft. The end play magnet is mounted in the usual manner opposite to the end of the shaft to be controlled. A switch in the circuit of this magnet is actuated by an auxiliary arrangement by means of which the switch is periodically opened and closed. The main switch is on the end of a rod actuated by a solenoid, which rod also gives motion to a pivoted auxiliary contact lever playing between two fixed stops. This lever carries a gear sector engaging a time train, the last shaft of which carries adjustable vanes which may be set so as to vary the speed of the train. When the lever touches one of the fixed stops, the solenoid is energized and moves in a direction to close the end play magnet circuit; but by the action of the time train this motion can be fixed at a definite rate. The main switch has a contact which remains closed for a certain period of the motion of the controlling lever, corresponding to the time necessary for the movement of the shaft.. When the end of the lever touches the second stop the solenoid is demagnetized and a spring draws the core back into its original position, its rate of motion in this case being also fixed by the time train. It will thus be seen that by this means the number of closures in a given time, and time of closure, may be very accurately fixed to correspond to the periodic oscillation of the shaft; moreover, the action of the apparatus is entirely automatic. A single controlling device may be used for any desired number of machines, and the end play magnets of the several machines periodically energized and de-energized to suit the natural period of oscillation of the shafts.

PROTECTION OF UNDERGROUND PIPING FROM ELECTROLYSIS.—It is not always recognized that electrolytic corrosion is a secondary and not a primary effect of the current acting, the secondary effect being chemical in its nature. That is to say, the current decomposes solutions present in the soil, notably the chlorides and sulphates, and the products produce corrosion. In a patent issued Nov. 6 to Prof. Lucien I. Blake a plan of protecting underground metallic structures is described, based upon the fact that a current which leaves a metallic surface by a conducting path which is

non-ionizable or not chemically decomposible, will produce no electrolytic effect on that surface. To this end, the pipe or other metallic structure to be protected has interposed between it and the surrounding soil an electrolytically conducting medium such as a mixture of grahpite with some binding material by means of which it may be applied and fixed to the surface of the metallic structure which it is designed to protect. A conductive mixture of graphite and paraffine is well adapted for this purpose, though it is not essential that the substance of the protective medium should be itself conductive, provided it permit the passage through it of current and will prevent access to the metal surface of the products of decomposition. Among such substances are precipitated chalk, pulverized anthracite coal and gelatinized compounds of silica, all of which, when used in layers of sufficient thickness and when moist, permit the passage of a current and prevent the recombination of the products of electro-decomposition. The protective medium may be applied in a thin layer with brushes, or may be deposited in larger amounts in a trench and the metal structures embedded in it. An incidental advantage of having metallic structures exposed to the soil, surrounded by a conducting substance, is that the sertngth of any electric currents from these structures will be enormously increased through the provision of innumerable points of exit, thereby relieving these structures of currents, which are harmful particularly at the joints.

ELECTRIC GOVERNOR FOR PRIME MOVERS.—The governors ordinarily used for controlling prime movers are dependent upon a change of speed in the prime mover and in many cases their action gives rise to a series of surgings above and below normal speed. These and other defects in the ordinary governing apparatus are especially objectionable when the prime mover is arranged for driving an electrical generator, and in a patent granted Nov. 6 to Ralph D. Mershon a method is described for overcoming these defects and to provide a governor for prime movers which is not dependent primarily for its action upon a change of speed in the motor governed, but which assumes a definite position for every load without regard to speed, and in which the range and variation of speed and the amount of fly-wheel effect necessary for securing stability are greatly reduced. The invention consists in making use as a controlling element of the governor apparatus of a wattmeter in combination with a speed indicator, actuated by the prime mover. The wattmeter actuates a lever and an ordinary centrifugal governor acts to shift the fulcrum of this lever. The combined action of these two devices is to adjust, when suitably applied, the supply of power to the prime mover to the load carried by it, and at the same time to maintain a substantial uniform speed. Assuming that a speed variation of, say, 2 per cent is allowed, then the speed indicator will arrest acceleration of speed beyond this limit, while within the prescribed limit the wattmeter will act to change the power supplied the instant there is need of any change by reason of change of load. This combination of the speed inductor and wattmeter is necessary for the reason that if the nature of the load be such that an increase of speed means an increase of power supplied by the prime mover, and if the throwing off of some of the load should produce an increase of speed, owing to the wattmeter taking considerable time to actuate the mechanism controlling the supply of power to the prime mover, the wattmeter without the indicator would reach the limit of its movement and continually call for more power as the load increased.

A NEIV FORM OF INDUCTOR GENERATOR.—Two patents were issued Nov. 6 on a new form of inductor generator, one being granted to John F. Kelly and the other to Cummings C. Chesney, both of Pittsfield, Mass. As is well known, the stationary element of the Stanley inductor machine consists of two windings, forming two separate armatures, while the magnetizing force is furnished by a large stationary energizing coil surrounding the rotating inductor. An objection stated as applying to this arrangement is that the energizing coils have to be shipped separately and are of such size as to make them exceedingly difficult to handle and to transport with safety. Moreover, it has further been found that by reason of the magnetomotive force set up in the shaft, which is surrounded by the inductor coil, stray magnetism is produced, which, when the generator is connected directly to its engine, magnetizes the engine, and might at times interfere with the governor action. Both patents propose to remedy these defects by applying the magnetizing force at a different portion of the magnetic circuit and by using a number of small coils to replace the large central coil. The magnetic circuit of the Stanley inductor machine consists of the laminated projections of the inductor and the structure connecting the latter, and of corresponding parts of the stationary armature. In the present type of Stanley machine, the magnetizing coil is linked with the magnetic circuit where the structure joins the two inductor laminations, and but a single large coil surrounding the entire inductor structure is necessary for magnetizing the machine. In the Kelly patent is is proposed to link the magnetizing coil with the magnetic circuit at the structure connecting the two armature rings. Consequently this arrangement provides for the location of a number of small magnetizing coils located in the structure of the permanent or armature part of the machine, instead of a single coil surrounding the inductor. The Chesney patent proposes to link the magnetizing force with the magnetic circuit by means of a coil for each leg of lamination of the stationary or armature structure, in this case also a number of such small coils being used.

LETTERS TO THE EDITORS.

Valuable Telephone Information.

To the Editors of Electrical World and Engineer:

SIRS:—Permit me to congratulate you upon the issue of Nov. 3, 1900, of the ELECTRICAL WORLD AND ENGINEER, which is, indeed, most interesting. I do not believe that I have ever before seen so much valuable telephonic information in one issue of a technical journal.

NEW YORK CITY. W. H. ECKERT.

An Association of Meter Experts.

To the Editors of Electrical World and Engineer:

SIRS:—Since your issue of Oct. 27, quite a few have written to me for information concerning the organization of an association of meter experts, there proposed. Just what would be the best plan at this time I am not prepared to say. We are arranging for a meeting of those interested in and about Boston to discuss plans, recognizing that we need the help of many who are now connected with other associations, and the press as well. Knowing that our suggestion has met with the approval of many central station managers, we feel encouraged to ask your opinion and any advice. I might mention that the idea of an affiliated society of the Nat. Electric Lt. Ass'n seems to strike a popular chord. R. FERRIS.

WEST SOMERVILLE, MASS.

Telephone Consolidations.

To the Editors of Electrical World and Engineer:

Sirs:—It may interest your readers to learn that the purchasing of all supplies for the Federal Telephone exchanges in the following named towns in Pennsylvania is taken care of at the general offices of the company in the Bissell Block, Pittsburg Pa.: Aliquippa, Avonmore, Belle Vernon, Bellevue, California, Coraopolis, Carnegie, Canonsburg, Charleroi, Esplen, Etna, Emsworth, Elizabeth, Elliott, Freeport, (Oakmont and Verona, under construction); Fayette City, Freedom, Glenfield, Irwin, Latrobe, Leechburg, Millvale, Monessen, McKeesport, Monongahela City, New Kensington, Pitcairn, Wilkinsburg, Wilmerding, Sewickley.

It may also be of interest to note that the following named telephone companies recorded in the directory of the National Telephone Association have all been absorbed by the Federal Telephone Company, and all correspondence for these companies should be sent to the same address: Elizabeth Telephone Company, Carnegie Telephone Company, Latrobe Telephone Company, McKeesport Telephone Company; Washington County Telephone Company, Washington, Pa.; Washington Telephone Company, Washington, Pa.; Kiskiminetas Valley Telephone Company, Apollo, Pa.; Pennsylvania Telegraph & Telephone Company, Beaver Falls, Pa.; Ewing Telephone Company, Avonmore, Pa.; Home Telephone Company, Cecil, Pa.; Home Mutual Telephone Company, Canonsburg, Pa.; Home Mutual Telephone Company, Houstonville, Pa.; Local Telephone Company, Leechburg, Pa.; Home Mutual Telephone Company, McDonald, Pa.; Home Mutual Telephone Company, Venice, Pa.; Mutual Home Telephone Company, Washington, Pa.; Youngstown Telephone Company, Coraopolis Telephone Company, Sewickley Telephone Company.

PITTSBURG, PA. FRED DE LAND.

Wireless Telegraphy Experiments.

To the Editors of Electrical World and Engineer:

Sirs:—In making some recent experiments on wireless telegraphy we have employed a Wimshurst machine fitted with one of their usual condensers for the production of high potential electricity. At some metres distance from this transmitter we have placed an ordinary Marconi receiver. The electric waves engendered by the sparks produced between the two balls of the Wimshurst machine spread out in all directions. In regard to the action on the coherer, these waves may be divided into three classes or parts: The first arrive directly on the coherer. The second encounter it only after being reflected, while the third part are without effect on it. In our tests, only the direct waves have any action on the coherer, for this remained inert when we intercepted them by the interposition of a screen between the coherer and the Wimshurst machine.

The human body fulfilled perfectly this screen function. The bell in the receiver circuit remained silent each time that one of us got between the receiver and the Wimshurst. Yet we could hardly say that it served as a conductor to ground, for it was carefully insulated from the earth. There was probably a phenomenon analogous to that met with in Röntgen radiography.

A thin sheet of iron being interposed, the coherer continued to work, but when we put it in touch with the ground, the face of the sheet being turned towards the transmitter, the coherer ceased to operate. The radiations had flowed to ground.

Since the interposition of the sheet iron when insulated allows the coherer to operate, while it ceases to work when one side of the sheet is put to ground, it seems necessary to conclude that the metallic sheet constitutes a new radiator working by the induction of the transmitter. The electric waves, then, neither pass through nor travel over a metal screen, but produce in this latter induced oscillatory currents which in their turn cause a radiation into space. This explains the fact already verified that sometimes a coherer protected behind a metallic screen is influenced.

The Hertzian waves, therefore, are susceptible of the phenomena of induction—phenomena which may be avoided by putting to ground one of the faces of the metallic sheet which is the seat of the induction. These experiences with shields put to ground have a considerable importance in connection with the Guarini repeater, to hinder the reverberation of the signals from one repeater to another and to avoid the action of a transmitter upon the coherer at the same station.

EMILE GUARINI.
BRUSSELS, BELGIUM. LIEUT. PONCELET.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS. MOTORS AND TRANSFORMERS.

E. M. F. of Alternators.—HAWKINS.—The first part of a paper on the calculation of the e. m. f. of an alternator on open circuit. It is usually assumed that the flux from a pole is strictly confined to the width of the pole-face and is uniform over its whole area. He attempts to show in what way and to what extent this approximate assumption may lead to error. He takes into account the fringe of lines which must necessarily surround the actual pole-face, and which shades off from the normal induction under the pole to zero at the interpolar line of symmetry. For this purpose the curves of induction in the air-gap for various ratios of pole width to pitch may be drawn after a method given by F. W. Carter, three such curves for the ratios 0.7, 0.5, 0.3 being shown in Fig. 1; the suumption has been made that the length of the single air-gap is 1-20th of the pitch. He then shows graphically the difference between the e. m. f. calculated under the assumption that there is no fringe, and the e. m. f. for which the fringes are shown in Fig. 1. The dotted line in Fig. 2 represents the average e. m. f. as varying with the ratio of the pole width to pitch, without fringe, while the full line curve shows the average e. m. f. given by the integration of the areas of the curves of Fig. 1. Both curves diverge more and more as the pole width decreases. He then begins a discussion of slotted armatures.—Lond. *Elec. Rev.*, Oct. 26.

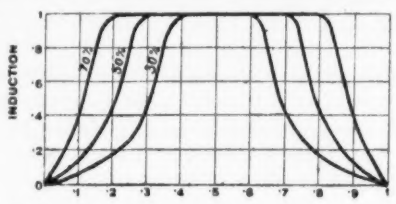


FIG. 1.—FLUX DISTRIBUTION ALONG PITCH LINE.

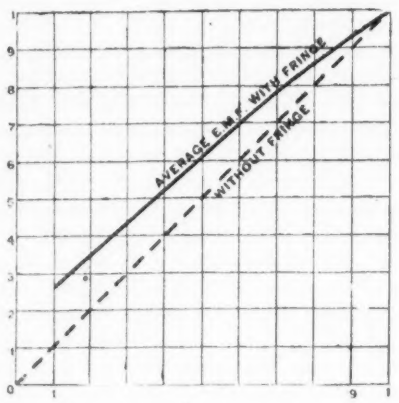


FIG. 2.—RATIO OF POLE WIDTH TO PITCH.

Winding Coils.—LOEWIT.—A brief article in which he gives a formula for finding the diameter of a wire for given dimensions of the coil, given e. m. f. and given ampere windings. In millimetres it is equal to 1.13 multiplied with the square root of the following quotient: The product of the ampere windings, the resistance of 1 meter wire having 1 mm. cross section, and the average circumference of the windings, divided by the e. m. f. Another formula is given for finding whether the coil, when so proportioned, is capable of carrying the current without too much heating.—*Elek. Zeit.*, Oct. 25.

REFERENCES.

Theory of Alternators.—WESTPHAL.—A mathematical paper, illustrated by diagrams, on the laws governing the distribution of the lines of magnetic induction over the circumference of an alternator. The principles developed in his former article (Digest, Sept. 29), are applied here to alternating current dynamos.—*Elek. Zeit.*, Oct. 25.

General Transformer Diagrams.—BEHREND.—A reply to the criticism of Emde (Digest, Oct. 13). He denies that according to his diagram the primary and secondary coefficients of straying must be equal.—*Elek. Zeit.*, Oct. 18.

Commutation.—HAWKINS.—The first part of a mathematical article on the theory of commutation. He develops the short-circuit equation taking into account the brush contact resistance. He reproduced the solution of the short-circuit equation, given by Arnold and Mie in a former paper.—Lond. *Elec.*, Oct. 26.

Constant Potential Direct Current Converter.—DAVIES.—A reprint of the illustrated English article, abstracted in the Digest Nov. 10.—*El'ty*, Nov. 7.

POWER.

Saving of Copper in Lines.—An editorial discussing the proposal of Bedell of a joint transmission of direct and alternating current (ELEC. WORLD AND ENG., June 13). It is said that his theory is correct, but that there may be difficulties in practice, the principal being the necessity, that for the direct current the same or nearly the same voltage is to be used as for the alternating current, which requires the connection of several direct current dynamos in series. The booster system of Forbes, which was noticed in the Digest June 2, 9, 23, July 7, 14, is also discussed.—*Elek. Zeit.*, Oct. 25.

High Speed Elevator.—COCHRANE.—The first part of an illustrated article on electric elevators for safe and economical operation at high speed. He mentions the requirements of a controller for such service and describes the mechanism of a winding drum elevator. He then discusses an automatic commutating device working in connection with a compound motor controller, and shows in a diagram the arrangement of a reversing switch, an automatic starting switch and an automatic series coil commutating device connected up with a compound motor; the action is fully described. In another diagram he shows in connection with the other general arrangement, an electrical method of control, which is also fully described.—*West. Elec.*, Nov. 3.

Tool Manufacturing Plant.—The first part of an illustrated description of the works of Ludwig Loewe & Co., of Berlin, Germany, for making machine tools. They are said to be the latest development of the best American practice; the articles made are largely modeled on American lines; "the whole is carried out to a point of perfection in detail that is very remarkable." Electric driving is installed, and could readily be extended to any improved system should it appear desirable, as, for instance, to use a motor to each tool, which so far does not seem desirable, the group system having been followed to some extent, and each room, at least, having its own motor.—Lond. *Elec. Rev.*, Oct. 26.

Water Power Plant.—CHILD.—An illustrated description of the water-power plant of the St. Lawrence Power Company, now in course of erection at Massena, N. Y. When finished, there will be installed what is said to be the largest aggregation of power generating machinery in the world, comprising 30 units, each of 5000 horse-power, of which seven are at present being put in place. The dynamos will generate three-phase currents at 2200 volts in each phase. It is expected that the power will all be utilized in the immediate vicinity of Massena by various manufacturing and chemical industries, which will be attracted there.—*Elec. Rev.*, Oct. 24.

Electricity in Mines.—WALSH.—An article in which he shows that the introduction of electricity in the Pennsylvania coal mines to operate the machinery has produced a considerable saving in getting out the raw material, and has also reduced the danger. He makes some remarks about electric coal-cutting machines.—*Elec. Rev.*, Oct. 31.

REFERENCES.

Water-Power Plant of Chevres.—A continuation of the long, illustrated article on this plant (Digest, Nov. 3). There are 15 generators, 14 of 1200 horse-power each, giving two-phase current, and one direct current. The two-phase generators are described.—Lond. *Elec. Rev.*, Oct. 26.

Direct-Current Transmission.—PERKINS.—A brief illustrated description of two Swiss power transmission plants, where the Thury high-tension, direct-current, series system is used.—*West. Elec.*, Oct. 27.

TRACTION.

Competition of Electric Automobiles.—An abstract of the long official report by Kallmann, on the competitive test of electric automobiles, held in Berlin in April, a preliminary account of which was noticed in the Digest June 16. An automobile, ideal in all respects, could have obtained 50 points; the three best automobiles received 41.7, 39.7 and 38.5 points. The weights of the battery varied between 121 lbs. and 286 lbs. per kw-hour; the average for all 13 automobiles was 165 lbs. The price of the battery was between $250 and $500 for passenger automobiles, and between $300 and $635 for freight automobiles; the price of the whole automobile, including battery, varied between $925 for the smallest passenger automobile and $2,250 for the largest, and between $1,125 and $2,000 for the freight automobiles. The price of the battery is, therefore, between one-third and one-sixth of the total price; he thinks that in future the price of the battery for a passenger automobile, running over 19 miles with one charge, will be about $250. Regarding the cost of repairs, etc., one battery manufacturing company guarantees 250 charges and discharges, so that after about 250 trips the full first cost would have to be paid. Another firm guarantees to keep the batteries in good order and to replace them, if necessary, for three years, at 30 per cent of the first cost. Under the supposition of an annual run of 9300 miles, he finds the annual cost of maintenance of the battery to be 1 cent per mile. The smallest amount of energy per ton kilometre for any automobile of the 1899 competition runs at Berlin was 87.4 watt-hours, while that of a special American automobile was 67; the best value in this year's exposition was 57, which value corresponded to an average speed, while at highest speed the consumption was 84.2 watt-hours. For most automobiles the energy consumption does not vary greatly with the speed; he, therefore, recommends getting the highest economy by running at as high a speed as is possible and is permitted. The best freight automobile consumed 77, 79 and 84.2 watt-hours per ton kilometre respectively at lowest, average and highest speeds. The capacity of the motors should be 1 kw-hour per ton of rolling weight.—*Elek. Zeit.*, Oct. 18.

Railway Track and Joints.—HALL.—A paper read before the Pa. St. R'y Ass'n. He claims that too much attention cannot be given to accurate gauging; many apparent imperfections in track are due entirely to irregularities of this kind, especially on suburban lines. The proper alignment at cross-overs or turnouts is more important than it is generally considered to be; the practice of leaving the gauge a little wide at the frog point should not be followed except where the conditions demand widening; and when such action is necessary the guard rail distance should also be increased exactly as much as the gauge is widened. Good rail joints are of the greatest importance. It is estimated that the loss of energy caused by the resistance to traction offered by low joints may be 2 hp-hours per mile of track; in addition there is the loss by wear and tear on the cars, track material, etc.—*El'ty*, Oct. 31. (See ELEC. WORLD AND ENG., Oct. 20.)

Transition Curves for Electric Railways.—SIEBER.—After calling attention to the great loss of power and the great wear and tear due to the use of curves of a single radius, he shows the advantages of using a transition curves; that is, a short curve of much larger radius joining the straight portion and the main part of the curve. A good transition curve is the cubic parabola, equations for which he gives and shows how it is applied. If necessary, a curve of small radius can be used together with transition curves, as the effect will be better than with a single curve of larger radius. He gives practical instructions for laying out such curves, and claims it to be so simple that it is very little trouble to use them.—*Elek. Zeit.*, Oct. 18.

REFERENCES.

Street Railway Association Meeting.—A full account in detail of the proceedings of the annual meeting of the Am. St. R'y Ass'n in Kansas City. Daily edition of the *St. R'y Rev.*, Oct. 17, 18, 19, 20.

Kansas City.—A very long, illustrated description of the Metropolitan St. R'y system of the two Kansas Cities; also a shorter description of the East Side Elec. R'y Co.; an article, by Henry, on "Early electric railway experiments in Kansas City"; and another, by Lawless, giving "Personal reminiscences of early cable street railway work in Kansas City."—*St. R'y Rev.*, October.

Consolidation of Street Railways.—HOLMES.—His paper in full, read before the Am. St. R'y Ass'n, on "Consolidation of street railways and its effect upon the public," which was abstracted in the ELEC. WORLD AND ENG., Oct. 20, p. 627.—*West. Elec.*, Oct. 27.

London.—An illustrated article, giving some information on the progress of the electric installation of the lines of the London United Tramways Co. There are difficulties with the Kew Observatory authorities, which fear that the electric tramways may interfere with their work. The power station of the lines, which is in course of erection, will contain four steam-driven 250-hp direct current generators, supplying current at 500 volts directly to the line, and a 5000-volt, 500-kw three-phase generator for supplying current to two converter sub-stations.—Lond. *Elec.*, Oct. 26.

Double Truck Cars.—HEFT.—A reprint of paper, without diagrams, read before the Am. St. R'y Ass'n on "Double truck cars; how to construct and equip them to obtain maximum efficiency with minimum cost of maintenance," which was noticed in the ELEC. WORLD AND ENG., Oct. 20, p. 627.—*El'ty*, Oct. 31.

Electric Automobile.—An illustrated article giving a working drawing of an electric coupé. The mechanical details of the design are shown and described.—*The Hub; Sc. Amer. Sup.*, Oct. 20.

Automobile Factory.—An illustrated description of the factory of the Electric Vehicle Company at Hartford, Conn.—*Elec. Rev.*, Oct. 24.

Fire Automobiles.—An illustrated article on the electric automobile of the Paris fire department.—*Sc. Amer.*, Oct. 27.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Alternating Current Plants.—MEYER.—An article, with diagrams, discussing the differences between the alternating current practice in the United States and in Germany. In Germany there are stricter official regulations than in the United States. In the United States there is a greater variety in the applications of the different systems. While in the United States various frequencies are in use, in Germany in general there is only one frequency used, namely 50 p. p. s. He discusses the special advantage of different frequencies and describes the action of frequency changers. For calcium carbide and carborundum furnaces, he recommends frequencies between 10 and 20, on account of the self-induction. He then discusses the advantages of the single-phase, monocyclic, quarter-phase, three-phase and six-phase systems, with references to the practice in the United States. He finally deals with the special advantages of induction motors and of synchronous motors.—*Elek. Zeit.*, Oct. 18.

Office Building Installation.—An illustrated article on the electrical features of the Evening Star Building at Washington. There are five different sources of current; the basement contains a generating plant of three 50-kw, 110-volt dynamos, and a storage battery of 62 cells, giving 160-amp. for 8 hours, or 320-amp. for 3 hours; in case of an accident, the street circuits can be connected to the lighting and power bus-bars; current is also supplied from two isolated plants in two buildings in the neighborhood. The switchboard is described in detail. The wiring provides for a total capacity of about 1600 lights of 16 candle-power and 300 horse-power in motors.—*West. Elec.*, Nov. 3.

Small Plants.—An editorial on "Small isolated electricity works.' Attention is called to the fact that in Great Britain the present tendency is to erect a separate supply station in each little village; this "is injurious to the industrial welfare of the country, and in the long run it will prove highly injurious also to the best interests of electrical industry." It is hoped that these conditions may be changed by an alteration in the law with respect to the granting of provisional orders. Blame is laid for the present conditions upon politicians and consulting engineers.—Lond. *Elec.*, Oct. 26.

REFERENCES.

Storage Battery Plant.—An illustrated description of the storage battery in a converter sub-station which is being erected by the Kansas City Electric Light Company. The battery consists of 140 cells, and is capable of discharging 2000-amp. at a 400-amp. rate for 5 hours: in one hour it can discharge 800-amp.; it is charged at a rate of 300 amp. at 175 volts.—*West. Elec.*, Nov. 3. (See Elec. World and Eng., Nov. 3.)

Usage Factor.—An article giving some brief remarks on the question of the "usage factor" and the load factor in lighting plants and tramway stations.—Lond. *Elec. Rev.*, Oct. 26.

Buenos Ayres.—Hulke.—A long illustrated abstract of the article noticed in the Digest Nov. 10.—Lond. *Elec. Eng.*, Oct. 26.

Wires, Wiring and Conduits.

Screening Effect of Iron Tubes.—Feldmann and Herzog.—An article on the results obtained when an alternating current conductor is placed in an iron tube. These results are of a complicated nature, but cause an increase of the apparent resistance. They give approximate formulas for the increase of the reactance of the conductor and for the loss by eddy currents and hysteresis in the iron tube, and discuss several special cases. If two simple iron-armored cables are used for conducting alternating current, at high voltages it may occur that the cable itself consumes nearly the whole impressed e. m. f. They give in a table some results of such a test, and also in a diagram and a table the results of a test made to determine the influence of iron tubes upon a conductor placed in them; the increase of the apparent resistance is the greater, the narrower and thinner the tube is.—*Elek. Zeit.*, Oct. 18.

High Potential Underground Cables.—A note stating that in a series of experiments made by Floy, at St. Paul, Minn., "a current of 30,200 volts has been successfully sent through an underground cable three miles in length. * * * The cable consists of three copper conductors, each enclosed in a paper tube, and the whole encased in a lead sheet and laid in vitrified clay conduits. * * * As a result of this experiment, it is said that the company will employ an average potential of 25,000 volts, furnishing 5000 horse-power for lighting and power purposes." (It seems that three-phase currents are used).—*West. Elec.*, Oct. 27.

Aluminum Conductors.—A brief note, stating that the use of aluminus conductors in the small Northallerton electric lighting system has been a great success, and that no trouble has been experienced with them up to the present. Some of the lines intended originally to take a maximum current of 100 amperes are being loaded nightly with 250 amperes without any bad effect, and brass-socketted joints, put up in the first place merely as a makeshift, are still standing and had not given way even in a single instance.—Lond. *Elec.*, Oct. 26.

REFERENCES.

Faults in Cables.—Wright.—A reprint of the English article abstracted in the Digest Nov. 3.—*El'ty*, Oct. 31.

Electro-Physics and Magnetism.

Cathode and Roentgen Rays.—Rollins.—A paper, the first part of which deals with theories of the cathode stream. After a brief discussion of the ether theory and the material particle theory, he gives a summary of his long series of experiments, mentioned before in the Digest. In the second part he discusses different theories of Roentgen light. He concludes his paper with several remarks on the structure of the atom "as seen by the cathode stream and Roentgen light." He asks why should aluminum be transparent to X-light if this is an electromagnetic phenomenon like ordinary light? He shows that the solid atom theory fails to explain it. A compound atom is required; but the cathode stream theory, that the particles into which the atoms are broken are the ultimate units, cannot be true for they have a familiar spectrum. He suggests that the atom is made of sub-atoms; these are the cathode stream particles; there are as many kinds of sub-atoms as there are elements; the sub-atoms are compounds; they are made of the ultimate units of which the elements are composed; these ultimate units have the same size and weight; as the atoms have the same size and different weights, light atoms must contain fewer ultimate units than heavy ones, and therefore more space in these must be filled with ether; as the ether is the only transparent part, aluminum which contains more ether must be more transparent than, for instance, platinum.—*Am. Jour. of Sc.*, Nov.

X-Rays.—Rollins.—A continuation of his long serial. He gives a note on the bearing of the ether dissociation theory on the ionization theory of solution; he further gives his views of the structure of the atom as seen by cathode rays and X light (see abstract above). He gives some hints showing how to pump out an X-light tube; its good operation depends "upon gas amalgamated with the terminals to make an efficient cathode stream and X-light"; fresh gas can be supplied to the terminals in several ways; "the procedure in pumping a tube is not only to exhaust the glass and the space it encloses, but to remove so much gas from the terminals by the current as to prevent it from coming out so fast in use, as to make the vacuum so low the tube is rendered useless."—*Elec. Rev.*, Oct. 31.

Glow in Vacuum Tubes.—Stark.—An account of an investigation, made with special precautions, of the influence of heat upon the electric glow in a vacuum tube. All the results point to the theory that a simple increase of temperature stops the luminosity of a gas under an electric discharge. Hittorf's idea that this is due to a stoppage of the phosphoresence is hardly tenable in view of the dark spaces observed at ordinary temperatures. The probable explanation is that the increase of temperature brings about an increase in the conductivity, and a consequent reduction of the potential gradient.—*Ann der Physik.*, No. 10; abstracted in Lond. *Elec.*, Oct. 26.

Unipolar Discharge—Stark.—An article giving an explanation of the following phenomenon. When the charge of a body is increased beyond a certain point, a disruptive discharge takes place through the surrounding medium; on raising the temperature of the body to incandescence, the discharge potential is lowered and the lowering is greater for negative than for positive charges; therefore at a certain potential difference a negative charge alone will be discharged. He supposes that at the surface of the incandescent body, positive and negative ions are liberated; they are driven into the gas and produce or increase the conductivity of the latter. If the body is negatively charged, the negative ions are sent out with greater force, and since their speed is greater in every case than the speed of the positive ions, they will produce a greater amount of gaseous ionization than the positive ions would in a similar case. That ionization is the determining factor is shown by the fact that if a carbon filament charged to —100 volts is confronted with an electrode at —5000 volts, no charge passes, since the negative ions cannot leave the glowing filament; but a discharge passes at once on earthing the electrode.—*Phys. Zeit.*, Oct. 13; abstracted in Lond. *Elec.*, Oct. 26.

Magnetic Field Due to a Moving Electric Charge.—Cremieu.—A continuation of his investigation of the mutual action between a moving charge and a magnetic field. He tried whether a charging magnetic field produces any motion of an electric charge suspended in it, but could not find any such effect, although the conditions of his experiments were such that, according to the theory, such an effect had to be found.—*Comptes Rendus*, Oct. 8; abstracted in Lond. *Elec.*, Oct. 26.

Magnetization and Torsion.—Schreber.—A paper in which he develops the following relations between magnetization and torsion. Every iron or steel wire free from torsion acquires a permanent twist under magnetization, which, with increasing field intensity, tends toward a maximum. The direction of the torsion is independent

of the direction of magnetization; it is reversed several times in the same wire as the field increases in strength. In iron the previous history of the wire does not seem to affect the amount of the twist, but in steel it does. The permanent twist is greater in steel than in iron. Besides the permanent twist, the wire experiences a temporary twist, which increases with the field as soon as the permanent twist has attained its maximum. Beyond that maximum, the temporary twist has always the same sign.—*Phys. Zeit.*, Oct. 13; abstracted in Lond. *Elec.*, Oct. 26.

REFERENCES.

Alternating Currents.—GOLDSBOROUGH.—The first of a series of articles on "The theory of alternating dynamo-electric mechanism." He develops the fundamental formula for the e. m. f. induced in the armature of an alternator and gives a graphical and analytical representation of simple harmonic motion.—*Elec. Rev.*, Oct. 31.

Radio-Activity.—GUILLAUME.—A translation of his preface to the French edition of J. J. Thomson's "Electrical Discharges in Gases," giving an historical outline of the researches relating to the discharge in rarified gases and to the radiation from radio-active substances.—Lond.*Elec. Rev.*, Oct. 26.

ELECTRO-CHEMISTRY AND BATTERIES.

Calculating a Battery for a Given Output.—ROSSANDER and FORSBERG.—A description of an analytical and graphical method of calculating the required normal capacity of a battery of accumulators when the discharge is variable, as it is in most cases; in such calculations a complication arises due to the fact that the capacity diminishes as the discharge current increases, there being one certain capacity for each discharging current. The formula which they give is somewhat inconvenient to apply, but the graphical method seems to be comparatively simple and is based on a given discharging curve; both methods are illustrated with an example. In developing their formula they use the following equation giving the relation between the capacity and the discharging current, namely, that the discharging current in amperes raised to the 0.4 power multiplied by the capacity in ampere-hours, is equal to a constant for that battery; having given the capacity for a certain current, this constant can be calculated and from it can be determined the capacity for any other current. If the capacities for various currents are given by the maker, the exponent corresponding to 0.4 can be calculated more accurately for that battery, the formula above given being of a general and therefore only approximate character.—*Elek. Zeit.*, Oct. 25.

Electrolytic Baths with Glycerine.—An article describing a new method of preparing electrolytic baths, invented by Marino, of Brussels. The feature is that glycerine is exclusively used as solvent instead of water, in contradistinction to the formerly proposed method of adding a small quantity of glycerine to the bath. The advantages are said to be that currents of high voltage may be used (?), that the metallic precipitates are good and adhesive. A table is given of the percentage in which several salts of silver, zinc, copper, etc., are dissolved in glycerine. In some cases, where the salts are not soluble in glycerine at any ordinary temperature, they are at a higher temperature, which is therefore used, without the glycerine undergoing a partial decomposition. In such cases, where metallic salts are insoluble in glycerine, but soluble in other solvents, as alcohol, caustic potash, and in the inorganic and organic acids, etc., these solvents are used either alone or mixed with glycerine. The electric conductivity of the baths may be increased by adding to the finished electrolytes alkaline or ammoniacal salts, as well as organic acids, if they do not have an action on the salts of the metals to be precipitated; a table is given of such materials.—*Journal der Goldschmiedekunst;* translated in *Sc. Amer. Sup.*, Oct. 27.

Interference Films by Electrolysis.—A note on an experiment made by Vaughton with a dish containing dilute sulphuric acid with two sheets of aluminum as electrodes; when he had passed a strong current for a few minutes he found that the waterline of the anode had become strongly irridescent. From further experiments he concludes that this is due to the deposition on the aluminum of alumina films of gradually increasing thickness produced by the nascent oxygen liberated by the electrolysis at the anode.—Lond. *Elec.*, Oct. 26.

REFERENCES.

Engraving by Electricity.—An illustrated article on Rieder's method, noticed in the Digest Jan. 13, Apr. 21, May. 12.—*Sc. Amer.*, Nov. 3.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Determining the Frequency of an Alternating Current.—SAMOJLOFF.—In experiments with a disk, consisting of black and white sectors, he has found that when illuminated with an alternating current incandescent lamp, the disk appeared to stand still when revolving at a certain rate at which the alternations of black and white at any given point of the disk are synchronous with the alternation of the luminosity. Hence to find the frequency of the alternating current supplied to a lamp, it is only necessary to place a revolving disk near the lamp and to alter its speed until it appears to stand still; the number of white sectors, multiplied by the r. p. s., gives the number of reversals per second of the current. The frequency of a Wehnelt interrupter may be similarly determined by mounting it in parallel with an arc lamp and treating the latter as an alternating current lamp.—*Ann. der Physik.*, No. 10; abstracted in Lond. *Elec.*, Oct. 26.

Insulation Resistance Tests.—WRIGHT.—An article giving some "Notes on the testing of modern dielectrics at high voltages." In many cases specifications for cable contracts now lay particular stress upon the resistance of the dielectric to disruptive discharge, the general rule being that it shall be subjected to a testing pressure at least double that at which it is ultimately intended to work, for a certain predetermined period, and that the measurement of the insulation resistance in megohms, obtained after this stressing or straining test shall evidence no perceptible deterioration in the insulating qualitites of the dielectric; the latter is very important. Some notes are given, showing how to arrange such a test with an alternator and a transformer. Special stress is laid upon the gradually slowing down of the alternator after the completion of test, as this admits of an ordinary insulation test being made shortly after the stressing test.—Lond. *Elec. Rev.*, Oct. 26.

REFERENCES.

Acetylene Flame.—NICHOLS.—A Franklin Inst. paper, giving an account of an investigation of the properties of the acetylene flame, made for the purpose of determining its usefulness in the physical laboratory. He discusses the influence of age and of the mode of production, the effect of mixing acetylene with hydrogen, some characteristics of flames of pure acetylene, the temperature of the flame, the use of acetylene flame as a source of high temperatures, and the use of acetylene as a manometric standard.—*Jour. Frank. Inst.*, Nov.

TELEGRAPHY TELEPHONY AND SIGNALS.

Wireless Telegraphy.—BLONDEL and FERRIE.—A translation in abstract of an Internat. Elec. Congress paper on "The present state of wireless telegraphy." After some historical remarks on the development of telegraphy with Hertzian waves, they give a theory of the action of the emission on the vertical receiving wire. "The electrical oscillations spread up the wire and agitate the ether round the wire. From there the waves spread through the surrounding ether; the lines of electrostatic force being in planes through the wire and abutting normally on the earth, the lines of magnetic force being circles having the wires as axis. These lines of magnetic force are especially abundant near the surface of the earth in consequence of the well-known concentration effect in the propagation of waves along conducting surfaces. * * * The receiving wire being cut at divers heights by the spreading circles of magnetic force, becomes the seat of oscillatory e. m. fs. which act on the coherer. The longer the wire, the more circles of magnetic force cut it, and the stronger the effect on the coherer." Guided by this theory they have tried experiments when the capacity of the oscillator was greatly increased and the self-inductance greatly diminished; the apparatus was then virtually a plate condenser with a very short vertical wire, and with this arrangement medium results were obtained. They also discuss the apparatus used in the production of the waves and the coherer, but do not seem to advance anything new in this direction.—Lond. *Elec.*, Oct. 26.

Relays in Wireless Telegraphy.—GUARINI and PONCELET.—A paper on the construction of the relay. In a polarized relay the armature is immediately attracted by the core as soon as the first traces of a current traverse the coil; but before the relay circuit is closed the armature has to perform its excursion, which takes a certain time; such a retardation does not occur on breaking the circuit, as the least motion of the armature interrupts the relay circuit. The time required for the closing of the relay circuit becomes of importance when the number of successive relays is increased. They therefore

construct the relays so as to have very small armature excursions and to be sensitive to currents of only 0.00005 ampere.—*Comptes Rendus*, Oct. 8.

REFERENCES.

Pollak-Virag Telegraph System.—A reprint of the illustrated article from Lond. *Elec.*, which was abstracted in the Digest Nov. 10.—*El'ty*, Nov. 7.

Vienna.—DREISBACH.—A long, illustrated description of the telephone exchanges of Vienna.—*Elek. Zeit.*, Oct. 18, 25.

Type Printing Telegraph.—CONRADT.—A reply to the criticism of Pierart (Digest, Nov. 3).—*Elek. Zeit.*, Oct. 18.

MISCELLANEOUS.

REFERENCES.

Production of High Temperatures.—LANGE.—A reprint in abstract of his paper on the Goldschmidt process, noticed in the Digest Oct. 27.—*Eng. News*, Dec. 1.

Paris Exposition.—A description of an electric locomotive for working a rack railway, as well as on smooth rails, exhibited by the Swiss Soc'y of Winterthur. The rack mechanism is operated by a motor of 150 horse-power, running 700 r. p. m. The two series wound, 4-pole mortors for the carrying wheels develop together 50 horse-power when the locomotive is running 5½ miles per hour. The voltage is 500.—*The Eng.; Sc. Amer.*, Nov. 3.

An article giving brief illustrated descriptions of quite a number of the electric machines exhibited.—*Sc. Amer. Sup.*, Nov. 3.

The tenth part of the well-illustrated serial giving descriptions of the technical particulars of the moving platform and of the Moulineaux works.—Lond. *Elec.*, Oct. 26.

New Books.

ELECTRIC WIRING TABLES. By W. Perren Maycock, M. I. E. E. Whittaker & Company, London: Macmillan & Company, New York: 144 pages. Pocket size. Price, $1.

This is a very handy and useful little book, of vest-pocket size, neatly bound in green leather. The data are chiefly for electric lighting work and has been brought up to date. The book is, however, not of great use to American engineers here, as all the monetary values are figured on the English currency basis.

ELECTRICITY MADE SIMPLE. By Clark Caryl Haskins, Member of American Institute of Electrical Engineers. Clarence McDonald, 79 Fifth Avenue, Chicago, Ill.: 233 pages. Illustrated. Price, paper, 50 cents; cloth, $1.

This is a book which contains a remarkable amount of matter, for not only are there many pages, but the type is small and closely leaded. It would seem at first that Mr. Haskins had been verbose, but he knows the mental qualities of his friends in blouse and overalls, and has realized that in an explanation that really explains there cannot be too many helpful words for the man who really wants to learn.

The 21 chapters of this elementary book range through the art "from amber soul to telephone," from cats' fur to coherer, and are well illustrated. The sequence is conventional and in general the information is orthodox. The student who as a humble beginner masters this treatise will be greatly benefited and advanced. The diagrams may be commended for their clearness.

BOOK RECEIVED.

THE CONSTRUCTION OF LARGE INDUCTION COILS. A Workshop Handbook. By A. T. Hare, M.A. Methuen & Company, London: 155 pages, 35 illustrations. Price, $2.25.

The Development of the Magneto Telephone Signal.

BY N. H. HOLLAND.

EVEN before the telephone had passed the experimental stage it was foreseen that if it ever came into commercial use some satisfactory arrangement for calling the attention of the party at the other end of the line would have to be provided. Naturally, as the first experiments were made over telegraph lines, the ordinary telegraph signals produced by a sounder or tapper were used, but it was not long before special apparatus was developed. As the telephone came into wider use, the importance of proper signalling apparatus was fully recognized; and at the present day when a telephone system is under consideration, the signalling part of the equipment is generally one of the first questions to be decided upon.

The use of a vibrating bell and battery for signalling purposes has been limited in this country almost entirely to interior telephone installations, or where the distance between stations is very short. In Europe, battery call has been used to a much greater extent and over considerable distances; but it is usual there to employ a relay by which to close the circuit of a local battery to ring the bell. The limited distance to which the battery signal could be used without greatly increasing the number of cells led at an early date to an effort being made to secure some other means of generating a signalling current, and many forms of signals depending for their energy upon some source of magnetic inductive generator were produced. Probably the simplest form of such a signal was the use of the regular receiver by providing some arrangement so that the diaphragm could be violently vibrated, thus producing comparatively strong currents in the local coil, which would in turn after traversing the line throw the diaphragm at the distant end into corresponding vibration and create a sort of whistling sound. A good form of such a call was that used in what was known as the Gower-Bell telephone. In this instance, however, instead of vibrating the diaphragm directly, a small reed inside the receiver was set in motion making a call which could be heard quite a distance from the instrument.

Another plan in which the receiver was made to serve as a call was devised by Siemens. In this the telephone receiver is quite a large instrument, weighing about two pounds. It is of a bipolar type, and between the magnets—just below the spools—an armature was mounted in such a manner that it could be rapidly rotated by means of a small handle outside the case. This armature had no wire, and consisted of two pieces of iron separated in the centre by a section of brass; and when in motion it alternately shunted the diaphragm of the receiver so that it was thrown into rapid vibration. To intensify the sound at the receiving end, the instrument was left with the diaphragm end up; and a small shot was laid on the diaphragm, which increased the sound when it was set in motion.

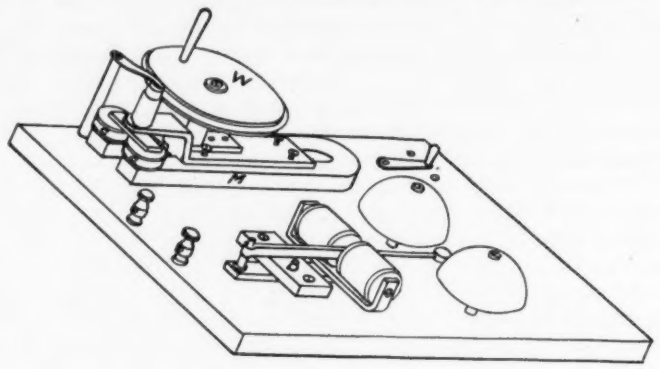


FIG. I.

It was but a few months after Bell received his telephone patent that Mr. Watson obtained a patent or patents on magneto signalling apparatus which have come into use very generally as a telephone signal; although his generator has been considerably changed. Fig. 1 shows how the signalling apparatus as shown in that patent was constructed. It was very similar to the magneto calls used in the first commercial telephones. It will be recognized as resembling a certain type of medical magneto-electric machine in use at the present day. Before a large horseshoe magnet *M* are mounted the two coils *C, C*, these coils being capable of rapid rotation by means of the friction wheel *W*; *B* represents the polarized bell shown in the patent as accompanying the generator described, although Mr. Watson about the same date also secured a patent upon the centrally-pivoted ringer now so universally used.

A very promising form of magneto signal was that shown in Fig. 2, and it certainly had some good points to recommend it. The method in which it operates is as follows: Between the two horseshoe magnets *N* and *S* is supported by a strong flat spring the coil *C*. This coil is equipped with a small handle which projects below the magnets and which is intended to be drawn to one side and then allowed to swing back. In thus swinging between the magnets, currents were, of course, generated in the coil, and as the operation would be repeated rapidly, quite a satisfactory signal was produced. Fig. 3 shows the curve of the e. m. f. produced by a generator of this kind. The high peak or pressure obtained while the coil is passing from one magnet

to the other will be noted. The bell that is intended to be used for this form of generator is shown in Fig. 4. It consists, as will be readily seen, of a hollow spool of wire mounted upon a permanent magnet *M*. An iron core *D* which goes through the spool is fastened by a flat spring at one end and equipped with a clapper or hammer for striking a gong at the other end. This iron core is magnetized by the current coming over the line, which, being of an alternating character, changes polarity in rapid succession. The core being much smaller in diameter than the hole through the coil, is attracted to the north or south pole of the permanent magnet according to the direction of the current, and thus produces the signal.

While the generator part of the foregoing apparatus has some good points to recommend it, it never came into very extensive use. In 1854 Siemens devised an armature for his dynamo-electric machine which was of very simple construction; and although primarily it was intended for electric light purposes, it has been found especially well suited for use in connection with generators intended to produce a signalling current. An armature of this type rotated between the prongs of three or four horseshoe magnets is the generator that is used to-day (Fig. 5) for telephone work, and has been found best suited to meet all the requirements in that class of service. It is necessary that an armature for a machine of the above construction should be rotated at considerable speed in order to get the best results, and this is secured by means of some intermediate gearing. The usual ratio in gearing is about 5 to 1, which at the ordinary speed that would be developed by hand would rotate the armature about 1000 to 1500 r. p. m.; and this would produce a current having a frequency of about 32 alternations per second. Friction gearing was very popular at first, but it was found that owing to the small size of the pinion necessary it was very difficult to produce a gearing of this kind that would wear any length of time, therefore tooth gearing was employed. The only trouble about cut gearing seems to be the noise produced by it when in operation. This, however, has been greatly modified by a proper cutting of the teeth; and where the pinion wheel is mounted in a flexible manner to the shaft of the armature the noise will practically disappear. One method of fastening the pinion wheel is shown as Fig. 6.

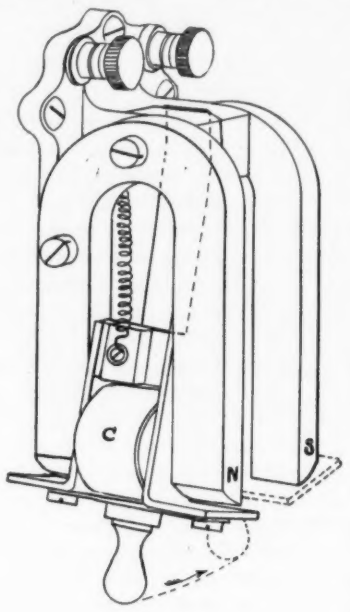


FIG. 2.

Another method quite largely used is that of a chain and sprocket similar to the drive of a bicycle. This appears to be very satisfactory where a properly made chain is employed, i. e., one that will not easily stretch or wear out. Fig. 5 shows a chain-driven generator. In particular cases, generators have been driven by means of a ratchet arrangement operated by a lever; the lever being pulled down, would rapidly rotate the armature, producing the proper signal. Instead of pulling down a lever, a push button has been employed to do the same work.

With the extension of telephone service, the magneto signal has been called upon for more severe duties, and has to be carefully designed for the amount of work it will have to do under certain conditions. Owing to the small amount and form of current generated, it is a difficult matter to determine the exact output of any particular magneto generator without careful measurement with special instruments. Of course, a regular alternating voltmeter will give a record of the pressure without load, but the ordinary wattmeter, even though adapted for alternating current, will show nothing of value as to what the actual output of the machine may be. The common method of rating magneto generators is very misleading; for instance, one hears generators referred to as being able to ring through ten, twenty or thirty thousand ohms, but this in the absence of any knowledge as to what the bell used in connection therewith will be wound to, gives no idea as to the strength of the generator in question. Of course, as 80 ohms (5000 turns) has become recognized as the standard winding in series bells, it should be assumed that the generator is rated as being capable of ringing such an 80-ohm bell through the resistance referred to; but that this is not generally recognized is evidenced by the frequency with which telephone men in specifying an order call for, say, a 20,000 ohm generator and a 500 ohm striker. If a generator only as strong as that usually employed in series bells, and which will ring an 80 ohm striker through 10,000 ohms, were used with the 500 ohm ringer, it would signal through fully 30,000 ohms; whereas, it is quite probable that a stronger generator than the regular one in such a case would be wanted.

Of course, as the magneto generator is intended solely for the purpose of sending signals, it is perhaps more satisfactory for the telephone man to define its capacity of power according to the number of bells it can ring or the resistance it will operate through. It is therefore not necessary to specify a generator having an output of a certain number of watts, but it should be clearly understood in giving the rating of a generator to ring through a certain number of ohms, that the bell used in connection therewith is to have its coils wound to but 80 ohms.

A standard 3-magnet generator when carefully made will have about 5 watts output at a pressure of 80 volts and an armature speed of about 1500 r. p. m. It will be seen therefore that the amount of current given is very small indeed; the strikers, however, are so easily actuated that they take but very little current to operate them.

There are three principal ways in which a magneto generator may be made to increase its output. First, by increasing the strength of the fields. Second, by increasing the number of turns on the armature. Third, by giving the armature a greater speed. In the first case, to increase the strength of the field, means to use larger magnets or more of them, and the limit is soon reached in this direction, for the machine will become so bulky as to be impractical. Without increasing the size of the armature one is also limited as to the number of turns of wire that could be put on to advantage. If a generator of of ordinary 3-magnet size, it is found that after about 500 ohms is put on the resistance will begin to increase more rapidly than the e. m. f., so that to make additional turns will then really be a disadvantage.

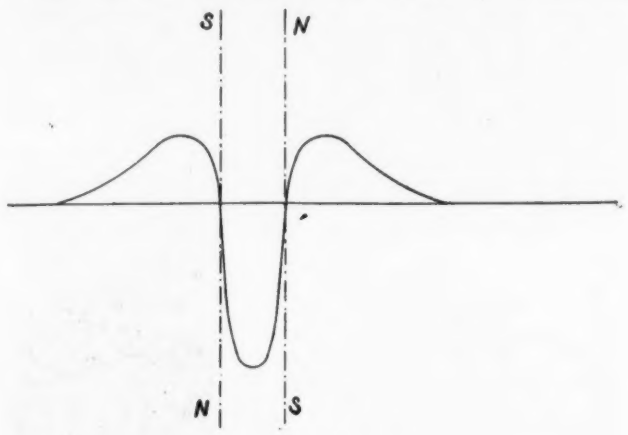


FIG. 3.

In an electric generator having a permanent magnetic field, the voltage is almost directly as the speed; it would therefore seem that in running the armature faster, a greater output could be obtained. The difficulty is that as the speed increases, the number of alternations per second are also increased, and they soon become so rapid that the polarized armature of the bell will not follow.

In Gray's patent of 1884, a generator is shown in which the fields are composed of electromagnets which were to be energized by the local battery. In this patent, Mr. Gray had an automatic arrangement which closed the battery circuit through these coils as soon as the handle of the generator was turned. There is no advantage to be gained by such a method of operation, and it creates an unnecessary waste of battery. The patent referred to has become famous, because it also covered the automatic shunting of the generator armature when not in use.

There are many details about the generator that have to be looked into to obtain the greatest output for a given size of machine. The permanent magnets should, of course, be just as strong as it is possible to make them; but this is a trick that takes some time to learn. It is also necessary that there be as little leakage of magnetic lines as possible, and to that end the air-gap between armatures and field should be so small as to just allow room for clearance. The substitution of laminated armatures for those of cast-iron has been a great

improvement, for while the laminations themselves, which merely prevent the formation of eddy currents, are not of great importance in a machine of so low a frequency as the telephone magneto, the difference between using cast and wrought iron is very important. By reference to any textbook on dynamo-electric machines, and examining the curves comparing the permeability of both wrought and cast iron, this will be quickly recognized. The rapidity with which wrought iron will change its polarity in comparison with cast-iron is also greatly in its favor. As the generator produces an alternating current, the manner in which the current changes from one sign to the other is of importance for the proper operation of polarized bells. Referring to the curves shown in Fig. 7, the portion of the curves above the line represents positive impulse, and that below it the negative impulse, the line being the neutral point.

The first curve shown is that which is known as a sine function, and to generate a current of this character would be the best for telephone purposes. Not only is such a current more easily transmitted, but it would create less induction in neighboring wires than if the curve were more abrupt. It is impossible to build a generator with a Siemens armature which will give a perfectly true sine curve, owing to the distortion of the field caused by the

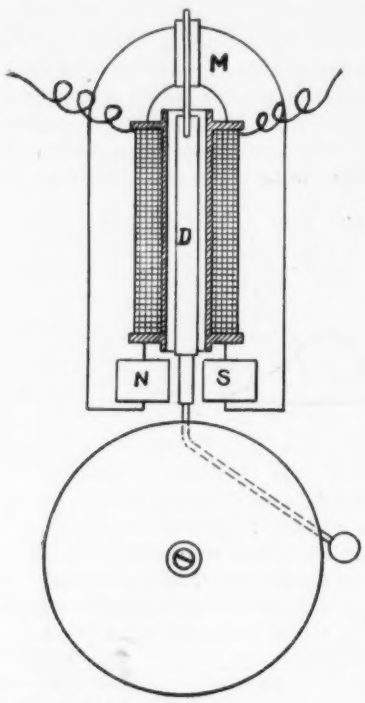


FIG. 4.

FIG. 5.

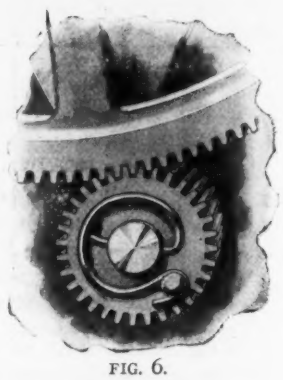


FIG. 6.

unequal distribution of the iron in the field space. The second curve is shown more pointed, and is produced from a generator in which the armature shoe is of such a size that it barely reaches from one pole to the other. The third curve which represents that from a generator that has an armature whose shoe overlaps one field before leaving the other, is probably the best that can be practically produced for telephone purposes. While the curve here shown is gradual enough to be easily transmitted and not subject to great impedance, the flattened top gives the maximum voltage of sufficient duration for the striker armature to obtain the benefit of it during its complete movement. Although some authorities believe that a short-pointed curve, such as shown at *B* in Fig. 7, is the best one for telephonic purposes, experience does not bear this out, and a generator that will deliver a curve such as is shown at *C* will be found to give more satisfactory signals.

What is of first interest to the practical telephone man is to know how many bells he can successfully place on the one line. Unfortunately, however, owing to the great differences between various makes of generators, it is impossible to give a definite rule in such cases. In series work, the limit is sooner reached in regard to talking than to signalling. In bridging work, the very reverse is the case, and the signalling apparatus is that which will first be found to limit further additions. A good series generator ought to ring through a resistance of 5000 ohms, fifty 80-ohm strikers; a 4-magnet bridging generator ought to ring through 2000 ohms, twenty 1000-ohm bells connected in multiple. These figures are not given as a basis as to what ought to be done, but rather as the extreme limit, for even with satisfactory signalling on a line with twenty instruments, the use that any one party would have of his telephone would be so limited that the value of his telephone service might be questioned.

A good way for parties who are contemplating the installation of a

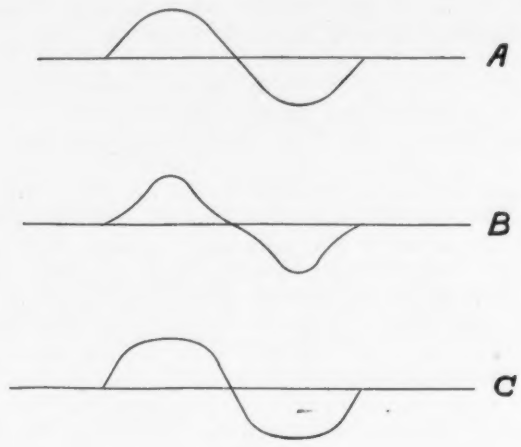


FIG. 7.

telephone system is to get from those from whom they buy the instruments, particulars as to the power of their special product, for, as noted above, such a difference exists between different makes that a fair estimate cannot be made. A better plan is, in writing the manufacturer, to state just what the requirements would be, and have them furnish ringing equipments that will satisfy the conditions. In bridging work, it is necessary to state full particulars as to the size of the line wire; and if grounded return is used, the character of the ground connection. It is also well to give a sketch of the line, giving an idea of the distribution of the various telephones thereon with the distances between them.

Of course, for an effective signalling apparatus is it just as important that the bell or receiving part of the equipment be efficient, as that the generator should. A number of different styles of polarized bells have been used, but nothing has yet equaled that form in which the armature is centrally pivoted in front of the electromagnets, a standard form of which is shown in Fig. 8, and this is the type that now is almost universally used for telephone work. Fig. 9 illustrates the manner in which it operates. In front of the electromagnet whose coils *H H* are connected in series is pivoted at *O* a soft iron armature. This armature is given a permanent magnetization by means of the steel magnet *P*, in such a manner that the lower half of it forms one pole and the upper half the other pole, divided as indicated by the dotted line. It is often supposed that the ends of this armature are the poles, as if it were a bar magnet with a neutral point at *O*. It is not desirable to have the permanent magnet too strong, as when that is the case the incoming signalling current will not be sufficiently strong to move the armature against it. It is also necessary that the magnetism from the permanent magnet be evenly distributed over the armature, and for that reason a striker having one bar permanent magnet is preferable to one having two, as it is practically impossible to produce several steel magnets that retain a uniform amount of magnetism. One of them is apt to exert a stronger influence on its end of the armature, and will tend to hold it against the incoming current. A great deal of trouble in strikers has been caused by using cast-iron frames in their construction, or iron for the core which was not soft enough. the result being that the striker would become so polarized that it would scarcely operate. Nothing but Norway iron properly annealed should be used for the construction of this part of the apparatus. When closely adjusted a well-made

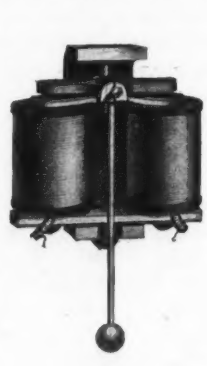


FIG. 8.

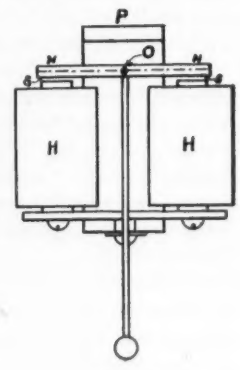


FIG. 9.

striker will operate with a very small current. Indeed, an 80-ohm bell can be actuated with a current as small as .08 of an ampere; a 1000-ohm bell with a current of .02 of an ampere, and a 1600-ohm bell (20,000 turns) with a current of .015 of an ampere. In adjusting the striker, the armature should have a play of from .015 to .017 of an inch, or about 1-64th for series bells. This adjustment where the armature is at the far end of the magnet as regards position of the gong will give an ample swing of the hammer, the gong should be then brought close enough to the hammer so that when it swings to each side it does not quite touch them, allowing the spring of the rod on which the hammer is mounted to carry it against the bell. A ringer with a short hammer rod is likely to be more sensitive as far as actual movement of the armature is concerned than a ringer employing a longer hammer, but as the distance of the armature from the magnet coils would have to be increased in order to obtain sufficient swing to make a satisfactory signal, nothing is gained by such construction, and for practical purposes the striker with the armature mounted at the opposite end of the coils to that on which the bells are mounted, is found to be most satisfactory.

There are many other methods or forms of signalling instruments that have been suggested and used for telephone purposes. One of the most often brought forward is the plan to use the local battery, and by means of an induction coil and vibrator step it up to ring polarized bells. As the ordinary induction coil has not an efficiency of even 50 per cent, such a method of operation would not be very economical of power; and, besides, an induction coil in which the primary current is made and broken but not reversed does not produce a true alternating current. All efforts in this direction have met with but little success.

The Automobile Club's Show in Madison Square Garden.

A special supplement of this journal was devoted last week to the splendid exhibition of the Automobile Club of America at Madison Square Garden. The matter was published while the Show was still in progress and before its success could be well gauged. In returning to the subject and making some further notes, it may now be said that the success far outran the expectations of the most sanguine members of the club, and that in the deep public interest aroused the event is likely to mark a new point of departure for the automobile in at least this part of the country. The attendance on the last day ran up to some 12,000, and at all times was quite remarkable. There was no hunting for sensations or souvenirs, but a demand for information and prices that all the representatives and salesmen present could not half meet. A great many sales were made during the week, and many more will result directly from the show. It was noticeable that the show was very lively during the earlier part of the day. Intending purchasers found it desirable to call in the morning or afternoon when a vehicle could be examined or tested quietly, for the crush in the evening was not altogether favorable to the serious pursuit of knowledge.

One pleasant incident was the supper given by the club to the manufacturers represented in the Garden. This took place on Friday, Nov. 9, at 11 p. m., when over 200 sat down in the handsomely decorated Assembly Room and spent three or four delightful hours of social intercourse, when many of those who have embarked their fortunes in the new industry became acquainted for the first time. The supper was presided over by Mr. A. C. Bostwick, in the enforced absence of President Shattuck, and after supper excellent speeches were made by Prof. R. H. Thurston, Mr. Eddy, the witty president of the Chicago Automobile Club, and Mr. G. F. Chamberlin.

A great feature of popular interest during the week, to the public, consisted in the various trials and competitions on the 20-ft. circular track. While many weighty objections were urged against these by some of the largest exhibitors, the fact remains undisputed that they were an attraction. The one night they were omitted, owing to the fact that there was but one entry in the class to be tried, no end of complaints and regrets from the public reached the management and the club office. The finals in the braking and obstacle competitions were held on Saturday night, when every point of vantage overlooking the track was crowded with enthusiastic spectators. In both classes, the event was won by an electric automobile against steam and gasoline. The braking contest was won by the Riker Motor Vehicle Company; distances, 14 ft. 6½ ins. in 6 2-5 seconds, and 15.11 in 6 2-5, from speed estimated at over 10 miles an hour. In the obstacle contest, the diploma was won by the Baker Electric Company, of Cleveland, in 24 4-5 and 30 2-5 seconds. The judges were Messrs. A. C. Bostwick, R. A. Fliess, C. J. Field and T. C. Martin, with Malcolm W. Ford as timekeeper and Mr. Toucey as starter. The events were so decisive as to leave no shadow of doubt, a matter of relief to the judges, who had to formulate their ratings and take many elements into consideration.

On Thursday evening there was a starting contest for gasoline vehicles in which the Automobile Company of America came out first, and the Knox Automobile Company second. There was also a most amusing gasoline tricycle "gymkhana" coat and waistcoat removal contest, in which Mr. H. J. Brandt, on a De Dion-Bouton tricycle came out first, and Mr. R. R. Ross, on an Orient tricycle, second.

Note has already been made of the charging facilities at the Show afforded by the "Electrant" of the General Electric Company. There was also an interesting little charging plant for electric vehicles on exhibition in the back of the Garden. It had one or two quite useful features. The unit was composed of a 1¼-hp gasoline motor direct connected to a small shunt-wound generator of 500 watts capacity. The arrangement starts automatically on throwing in the circuit breaker, the generator starting as a motor, its supply of current coming from the battery in the vehicle to be charged. When the gasoline motor reaches speed the relief cock is closed and the dynamo begins to charge the battery. A voltage cut-out is placed on the switchboard which is designed to operate when the batteries have become fully charged. The fuel valve of the gasoline motor is also closed on the opening of the circuit breaker, so that the stopping of the plant is entirely automatic. These units are self-oiling, use either gas or gasoline and are built for any capacity and are wound for any voltage.

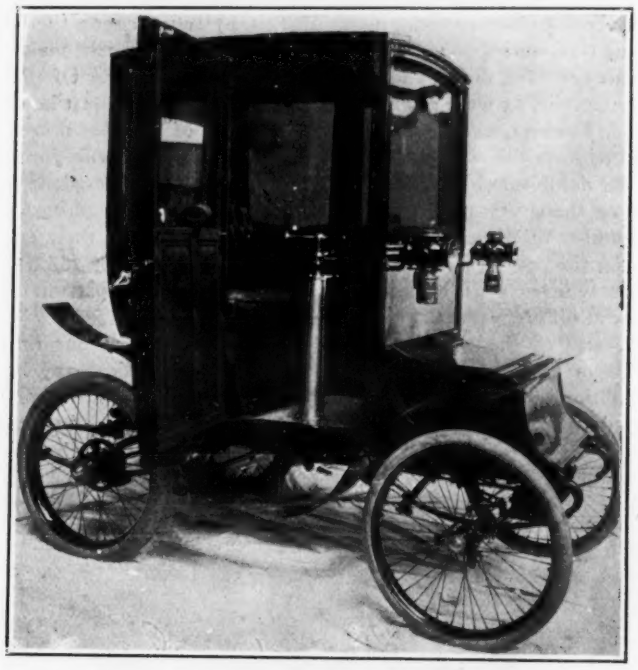


FIG. 1.—DOCTORS' GASOLINE COUPÉ.

Illustrations are shown herewith of one or two of the general exhibits described last week, but for which photographs could not then be obtained in time for use. We show also three or four new types of automobiles put on exhibition by the Electric Vehicle Company. These are its Mark Eleven 4 delivery wagon, Mark Twelve 3 victoria and Mark Seven jaunting car. (Fig. 4.) The company had a score of automobiles in its space, which was illustrated in these pages last week; as well as the "Electrant," of which a view was also shown in connection with a motor-generator outfit.

The demand for a vehicle of greater mileage capacity and a higher rate of speed than normal has been met by the Electric Vehicle Company with its Mark XIX Special. The novel appearance of this automobile is due to the extraordinary amount of battery carried—64 cells, instead of 44, as usual. The mileage capacity on one charge is 85. The controller speeds are 5, 9½ and 17 miles per hour. By operating a foot press a fourth speed, 23.4 miles per hour, is ob-

tained from the accelerator. The finish of this vehicle is in bright shades of maroon, although the dash is finished in black, as well as the mouldings. The vehicle, while not strikingly aesthetic, has a field of usefulness that is very considerable on account of its wide radius of action, and "looks a thoroughbred."

The question of participation in automobile shows was brought up, as noted last week, and on Saturday another meeting on the subject was held at the Garden, at which 30 firms were represented. The feeling in favor of two big shows a year, one East and one West, was re-emphasized in the discussion, but there was no formal opposition to shows already scheduled. A committee of eleven was appointed to draft a constitution and by-laws. The members of this committee are: S. T. Davis, Charles E. Miller, A. L. Riker, W. C. Baker, W. H. Weeks, J. B. Walker, C. E. Duryea, J. M. Hill, Alexander Winton, C. J. Field and A. J. Winslow. There are three makers of steam machines, three of gasoline, four of electric and one maker of parts and accessories. The show question received much attention, but nothing definite was done except to instruct the committee that a provision should be made whereby the secretary of the new organization should receive a written opinion from every member in the future on any and all shows proposed. It was voted to have a convention of automobile makers called at Buffalo next year during the Pan-American Exposition. Freights and other matters were discussed briefly. John Brisben Walker was temporary chairman and E. Ralph Estep was temporary secretary. The committee on constitution and by-laws will meet this week.

Last week we took special note of the electrical exhibit at the Show, but, of course, there were many vehicles other than those propelled by electric motors on exhibition. In fact, by actual count, there were at one time during the week some 226 vehicles of different makes and design collected under and on the roof of the Garden. Of these 70 were electric, 73 were steam and 81 were gasoline. It must be understood, however, that even the large number of vehicles noted does not include all those shown at the Garden during the week, for nearly all the exhibitors had a number of vehicles in almost constant operation on the streets of the city, taking out their friends and customers. A number of the exhibitors also added to or changed their exhibits during the course of the week, so that in all probability some 300 or more vehicles were brought to the attention of the patrons of the show at different times.

Several of the electric vehicle companies exhibited one or more steam or gasoline vehicles. The Electric Vehicle Company had on exhibition a very neat little Columbia gasoline runabout, here illustrated, with a seating capacity for two persons. This little vehicle can carry water and gasoline enough for a run of 100 miles without refilling, it is said. The vehicle will be found very useful in places where no charging stations for electric vehicles have been erected, as well as for long runs beyond the capacity of the electric vehicle on one charge of its battery.

The Locomobile Company of America had a well-placed exhibit in the centre of the main floor, where it showed some 14 vehicles. It had a sectional carriage on view, which gave an opportunity to the public to "see how the wheels go round"; and a nickel-plated model of the engine used in their vehicles. They also had on exhibition a depot wagon which, it is said, is probably the first closed steam carriage ever built. Also a single-seated racer with a record of a mile in 1 minute 6 seconds. This little vehicle was equipped with a stove-pipe arrangement in the back to improve the draught, which gave it an odd appearance. The engine is of 5 horse-power. There were also a canopy top surrey with a seating capacity for four passengers, and a buggy top surrey on exhibition; while several of the well-known runabouts, victoria-top runabouts and four-passenger open surreys of this company were shown. There were a number of the vehicles of this make shown on the track.

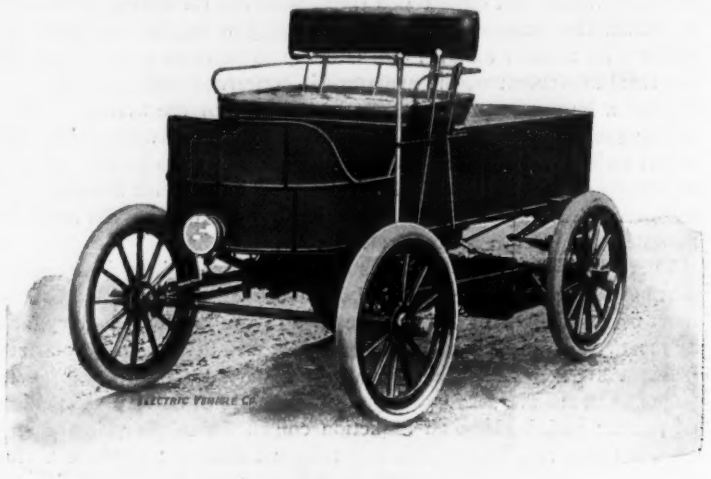


FIG. 3.—COLUMBIA LONG-DISTANCE RUNABOUT.

The De Dion-Bouton "Motorette" Company, Brooklyn, N. Y., of which Cornelius J. Field, the chairman of the contests and exhibitions and technical committees of the Automobile Club of America is vice-president and general manager, had a very good exhibit, a photograph of which was shown in Fig. 8 of our supplement of last week. This company exhibited a doctors' coupé, an illustration of which is shown in Fig. 1. The vehicle is equipped with a 3½-hp De Dion-Bouton water-jacketed head motor, which can be operated continuously over any good and ordinary roads with its full load. The gasoline tank holds enough gasoline for a run of from 60 to 75 miles, according to the grades and the condition of the roads. A variation in speed of from 1 to 20 miles per hour can be obtained. As will be noticed, the vehicle is especially adapted for use in bad weather or at night. It is a style of vehicle that should take well with the medical profession. A running gear, to which any desired style of body can be attached, was exhibited, to show the uninitiated public the mechanism by which this class of vehicle is propelled. An example of the "Brooklyn" type of motorette was shown. This is a little two-passenger one-seated runabout. It has its centre of gravity very low, which permits of high speed on turning corners without fear of an upset. It is equipped with a 2¾-hp motor and has a speed of from 1 to 25 miles. It weighs but 450 lbs. and costs only $2 a pound, which is still very reasonable for an automobile. There was a surrey type "motorette" with a 5-hp motor shown, which could carry four passengers, and a quadricycle with a 2¾-hp motor. A

FIG. 2.—COLUMBIA VICTORIA.

FIG. 4.—GASOLINE JAUNTING CAR.

"New York" type "motorette" was also shown. This style of "motorette" has a seating capacity for three persons and is equipped with a 3½-hp motor. The company also had on exhibition motors ranging from 1¾ to 5 horse-power.

The Winton Motor Carriage Company, of Cleveland, Ohio, had on exhibition three vehicles—a four-passenger surrey, a light delivery wagon and a single-seated vehicle of the well-known Winton type.

FIG. 5.—COLUMBIA NEW TYPE DELIVERY WAGON.

It had several vehicles running on the track and the Winton racer noted in our last issue was in its stand.

The "Autocar" Company, of Ardmore, Pa., showed a stanhope, dos-a-dos, runabout and a model of their two-cylinder "Otto" cycle engine with cranks set at 180 degs.

The Daimler Manufacturing Company, of Steinway, Long Island City, N. Y., had two delivery wagons on exhibition. They were equipped with the well-known Daimler motor. The motors were 6 horse-power and the wagons had a net carrying capacity of 2 tons

FIG. 6.—EXHIBIT OF BAKER MOTOR-VEHICLE COMPANY.

and a speed up to 12 miles per hour. In connection with the cooling water, a fan is used which draws the air past and over the radiating surfaces so rapidly that the water does not have to be renewed oftener than once in six weeks, it is said.

The American Bicycle Company showed a Toledo steam carriage with seating capacity for two persons, which was very elaborately finished. The vehicle is equipped with two chains and has a locking device on the throttle valve handle, intended to prevent the vehicle from being stolen when left unattended by its operator. It has a two-cylinder engine, each cylinder of which is 3½ ins. x 4¼ ins., and the vehicle costs but $750, another noteworthy item as to present conditions.

The Mobile Company of America had an extensive exhibit. It showed three vehicles of its well-known runabout style in a space on the floor of the Annex, and had 22 vehicles on exhibition on the roof of the Garden, where an artificial hill of varying grade had been erected. A photograph of part of this hill was shown in Fig. 2 of our supplement last week. "Mobiles" were run up this hill at stated intervals during the week to show the ease with which mechanically propelled vehicles can "negotiate" grades that would cause a horse considerable trouble. This company also had a number of vehicles running on the track.

The Knox Automobile Company, of Springfield, Mass., had a little two-passenger three-wheeled runabout of odd design on exhibition. The large size of the muffler used on this vehicle was an interesting feature and the good results obtained with it will probably lead to enlarging of the size of the mufflers used in gasoline vehicles in future. The radiation of the heat from the surface of the cylinder and combustion chamber of the motor is accomplished in a novel way. An immense number of grooved pins are attached to the heated surface, which, it is claimed, give three times the radiating surface exposed to the air that is obtained by any other system. The effect is to cause the motor to look like a bristling porcupine. This vehicle has no way of reversing its motor. A reverse is not necessary, it is claimed, as the vehicle, owing to its three-wheeled construction, can turn around in a 9-ft. circle. The differential in this vehicle is placed within the left-hand rear hub. The vehicle is said to weigh 650 lbs. and is equipped with a 5-hp motor.

Some fifteen or sixteen other firms exhibited gasoline or steam vehicles of many varieties, for all of which their owners had many good words, but enough has been said already to give an idea of the large number of vehicles exhibited at the Show and to indicate the amount of talent and energy displayed there.

EXHIBIT NOTES.

NEW PROCESS RAW HIDE COMPANY, of Syracuse, had a neat exhibit in the gallery, in charge of Mr. T. R. Meachem, and showed some very handsome bevel and spur gears. One example on view was a 5-in. pinion which had been on a trolley car for 14 months, the teeth showing natural signs of wear, but in a remarkably even manner, without any signs of disintegration.

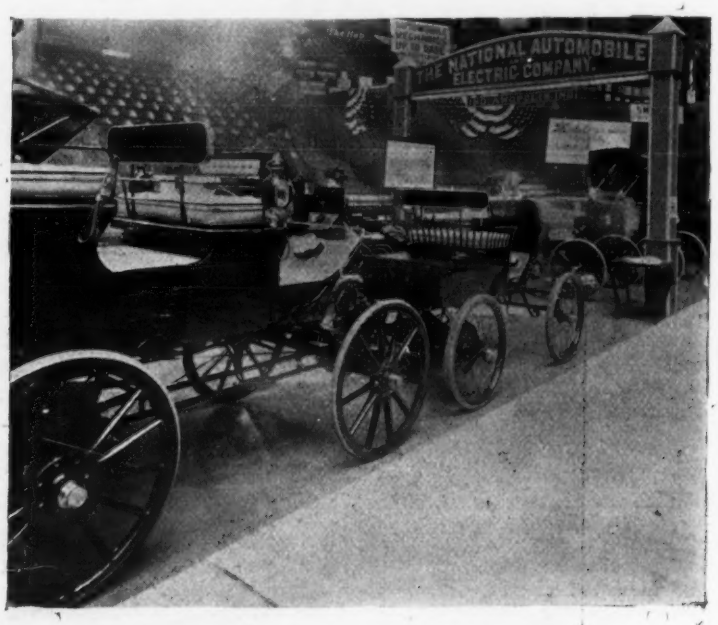


FIG. 7.—EXHIBIT OF NATIONAL AUTOMOBILE ELECTRIC COMPANY.

MR. C. F. SPLITDORF, of New York City, had a display of his induction coil, which is already well known as an excellent igniter, and with the two or three cells of Autogas battery shown gave a spark discharge 1 in. in length. The coil was also shown working on some Geissler tubes. A large number of the Splitdorf sparking outfits are now in use on hydrocarbon automobiles.

DOW PORTABLE ELECTRIC COMPANY, of Boston, showed its spark coil and dry cells. The coil is snugly enclosed in a fibre tube with

fibre heads, insulated with pure paraffine. Types of 4½ in. and 2½ in. diameter were shown. Its sparking plugs exhibited considerable care and neatness of design, as did its combination outfits.

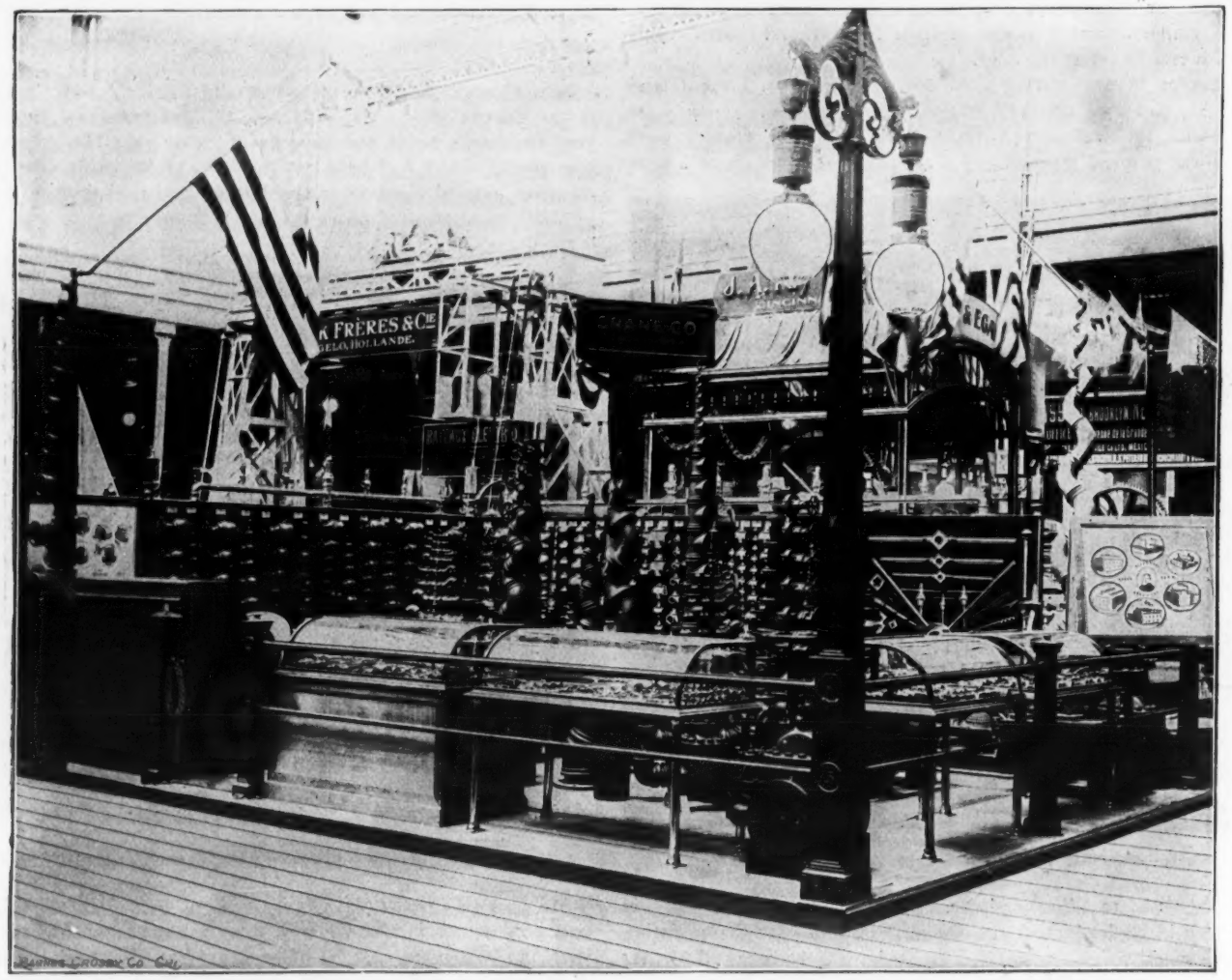
Automobile Show at Grand Central Palace.

With the close of one automobile show in New York another begins at the Grand Central Palace, which fills the block bounded by Lexington Avenue, Forty-third Street, Forty-fourth Street and Depew Place. There elaborate preparations for the ten-day show, opening on Wednesday evening, Nov. 14, and continuing its daily sessions from 10 a. m. to 11 p. m., are progressing rapidly. The Palace Show is not to be a dull duplicate of the Garden Show. It will be distinctly new. It will afford room for many vehicles that will be on view for the first time. At the Palace the track is the central feature, occupying the entire auditorium, and the exhibits are distributed around the track, a wide aisle intervening. A clear view of the entire track circuit is obtained from two commodious balconies of the auditorium. The space within the track is reserved for exhibitions of expert handling of automobiles.

The track is made of double flooring, smoothly planed and closely fitted, no nails being used in its construction, all joints being fastened with screws. This makes the track as smooth as a park boulevard. Landing stages, aside from the direct track, are provided to enable passengers to be taken on and off the vehicles without delaying those in motion. Features of the daily programme include afternoon and evening concerts by the Old Guard Band. All contests will be arranged by and conducted under the direction of a committee of the manufacturers exhibiting. The hall itself is decorated and illuminated, making the exposition a very attractive spectacle. Mr. Marcus Nathan is the manager. The exhibitors, exclusive of the later arrivals, include: American Electric Vehicle Company, New York; American Roller Bearing Company, Boston, Mass.; Buffalo Electric Carriage Company, Buffalo, N. Y.; Baldwin Cycle Chain Company, Worcester, Mass.; Canda Manufacturing Company, New York; Cooke Locomotive & Machine Company (Thornycroft Steam Truck), Paterson, N. J.; De Dion-Bouton Motorette Company, Brooklyn, N. Y.; Dayton Electrical Manufacturing Company, Dayton, Ohio; Denison Electric Engineering Company, New Haven, Conn.; Downing, C. J., New York; Electric Vehicle Company, New York; Gleason-Peters Air Pump Company, New York; Gray & Davis, Amesbury, Mass.; Holyoke Automobile Company, Holyoke, Mass.; Hartford Rubber Works Company, Hartford, Conn.; Janney, Steinmetz & Company, Philadelphia, Pa.; Knox Automobile Company, Springfield, Mass.; Locomobile Company of America, New York; Lehman Brothers (Carriage Heaters),, New York; Maryland Automobile Manufacturing Company, Cumberland, Md.; Marlboro Automobile & Carriage Company, Marlboro, Mass.; Mobile Company of America, Tarrytown, N. Y.; New Haven Carriage Company, New Haven, Conn.; Overman Automobile Company, New York; Oneida Automobile Company, Oneida, N. Y.; Standard Auto & Vehicle Company, Boston, Mass.; Strong & Rogers (Electric Vehicle), Cleveland, Ohio; Thomas, E. R., Motor Company, Buffalo, N. Y.; Tripler Liquid Air Company (vehicle propelled by liquid air, first time shown to the public), New York; Woods Motor Vehicle Company, Chicago, Ill.

Valve Exhibit at the Paris Exposition.

One of the exhibits at the Paris Exposition which attracted wide attention was that of the Crane Company, whose head offices and factories are located in Chicago. This exhibit occupied a desirable position in the Palace of Machinery and Electricity, Champs de Mars, and consisted of brass and iron valves and cocks for all pressures, brass and iron fittings, steam specialties, engineers' supplies and steam and gas fitters' tools. The Crane Company was the only exhibitor of this class of goods to receive a gold medal. The exhibit was tastefully arranged, as will be seen from the accompanying cut, and gave an especially good opportunity to visitors to study approved modern methods of piping, flanged work, etc., for power plants—a branch of the business which has become very important with this company.



AN ATTRACTIVE EXHIBIT OF VALVES AT THE PARIS EXPOSITION.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Wide and active speculation has prevailed in the stock market since the election, with advances throughout the list. All classes of securities felt the benefits of the new life infused into the market, and many stocks made great upward jumps as the week advanced. The electrical list participated in the general movement, some of the stocks increasing in value to an extent almost unparalleled. The Traction stocks were leading features. Manhattan, in particular, had vigorous pool support and rose to 109, partly on further reports of a satisfactory deal with the city officials and partly on prognostications about the improved earnings to follow the use of electrical power. Metropolitan was also higher on good buying, while Brooklyn Rapid Transit advanced rapidly, mainly on enforced covering of shorts, the price going up from 61⅞ to 70½. Metropolitan Street Railway heads the list with a gain of 9 points, the number of shares sold being 37,209. Brooklyn Rapid Transit advanced 7⅞ points, the sales being 184,785; General Electric, 6 points, and Western Union 3¼ points. Outside securities, in common with those in the regular market, exhibited considerable activity as a consequence of the election, and there was a general and material advance in prices, the electrics sharing to some degree in the buoyancy. Electric Boat, common and preferred, and Electric Vehicle closed with a gain of 1 point each. In the money market, call loans were 4 to 6 per cent, most of the business being at 4 per cent. Time money is quoted at 4½ per cent for 30 days and 5 per cent for longer periods. Commercial paper was inactive, with limited buying, the rates being based on 4½ per cent or better for prime double names. The closing quotations of stocks in New York, Boston, Philadelphia and Chicago follow:

NEW YORK.

	Nov. 3.	Nov. 10.		Nov. 3.	Nov. 10.
Gen. Elec.	142	148	Elec. Veh.	18½	19
Bklyn Rap. Tran.	60⅞	68¾	Elec. Veh, pfd.	38	40
Met. St. Ry.	158¾	167¾	Gen. Car.	4⅛	4¾
Am. Tel & C.	—	92	Ill. Elec. Veh. Tran.	1	1
West. Un. Tel.	80¾	84	N. Y. Elec. Veh. Tran	7	7¼
Am. Dist. Tel.	35	—	N. E. Elec. Veh. Tran.	3¼	3¾
Com. Cable.	—	—	Tel. & Tel Co. of Am.	5	5
Elec. Boat	20	20	Hud. Riv. Tel.	116	116
Elec. Boat, pfd.	42	41	N. Y. & N. J. Tel.	160	150

BOSTON.

	Nov. 3.	Nov. 10.		Nov. 3.	Nov. 10.
New Eng. Tel.	123	126	Erie Tel.	98	102
Mex. Tel.	2⅛	—	Gen. Elec., pfd.	140	140
Westing. Elec.	*49½	—	Am. Tel. & Tel.	148	153
Westing. Elec., pfd.	—	64½	Ed. Elec. Lt.	—	—

PHILADELPHIA.

	Nov. 3.	Nov. 10.		Nov. 3.	Nov. 10.
Elec. Stor. Bat.	69	81	Phil. Elec.	2⅞	3
Elec. Stor. Bat., pfd.	75	83½	Pa. Elec. Veh.	4	4
Elec. Co. of Am.	10¼	10⅜	Pa. Elec. Veh., pfd.	*2	*2
Gen. Elec. Auto.	¼	¼	Am. Rys.	31¼	36½

CHICAGO.

	Nov. 3.	Nov. 10.		Nov. 3.	Nov. 10.
Chicago Edison.	—	139	Chicago Telep. Co.	—	210
Chic. City Ry.	—	250	Union Traction.	—	12
Nat'l Carbon.	—	163⅛	Union Traction, pfd.	—	51
Nat'l Carbon, pfd.	—	82½	Northwest Elev. Com.	—	30

*Asked.

EXTENSIVE TROLLEY SYSTEM.—Steps have been taken to gridiron the northern part of Westchester County, New York State, and Connecticut by the Peekskill Lighting & Railroad Company, which has filed a mortgage for $750,000 in the Register's office at White Plains. The mortgage is made in favor of the New York Security & Trust Company for the purpose of enabling the company to carry on the construction of extensions to its trolley system. The company issued 750 bonds of the par value of $1,000 each, payable in gold. The mortgage is signed by President Benjamin B. Nostrand and Secretary Alfred Ely, of the trolley company. The company now proposes to extend its trolley road at Peekskill through the town of Cortland to Brewster, and from there easterly to Danbury, Conn. At that point a connection will be made by the Connecticut Trolley Company, which proposes to build a through line from New Haven to Greenwich, and thence to Danbury, passing through South Norwalk, Stamford and Bridgeport. Another extension will be built from Peekskill to Verplank's Point, and if franchises can be secured the road will be extended to Sing Sing to connect with the Ossining trolley road. The Huckleberry Company now operates cars from the Harlem River through the Bronx and Westchester to New Rochelle, Mamaroneck and Tarrytown, on the Hudson, while it also makes connection with a line running to Port Chester. With the proposed new trolley roads to be built, Westchester and Connecticut will have a network of trolleys gridironing both county and State, and covering cross-country routes of nearly 200 miles.

THE FUTURE OF INDUSTRIALS.—In some remarks on the recent striking rise in the price of securities, Mr. Alfred de Cordova, the well-known leader in Wall Street, said: "The tirade set up against combined business interests, the vile, iniquitous attacks made on them, failed to draw forth from the majority of thinking men the condemnation solicited. These combinations of interests when well managed are bound to make money and assert their real value to the investor, and offer large profits to the speculator. I have been man and boy in Wall Street for many years. I have wintered and summered with those that have gone, and with those that remain—but I can never remember a time when Wall Street offered so many attractions to the speculative world, or when there was, to my mind, a more solid foundation to start a bull movement on. Wall Street runs to two extremes. We have had extreme dullness and depression. We are having—and are going to have—great activity and exhilaration. The great speculation and the buying of A. O. T. (any old thing) will shortly be with us, with its attendant inevitable results." There is no doubt that electricals will receive plenty of attention and that some worthless electrical enterprises will, as Mr. de Cordova intimates, be pushed on the notice of innocent investors. But offsetting this, there are, as he notes, a great many legitimate opportunities.

MASSACHUSETTS ELECTRIC COMPANIES.—The Railroad Commissioners, on the petition of the Lynn & Boston Street Railway Company for the approval of an issue of $1,500,000 capital stock in addition to its present capital of $2,271,000, have authorized an additional issue of $1,016,000 stock to be applied as follows: $124,000 for refunding at par certain outstanding bonds amounting to $161,200; $607,000 for payment and funding at par of outstanding coupon notes amounting to $789,100; $54,000 for additional rolling stock; $138,000 for improvements in the power station at Salem; $29,000 for improvements in the Wakefield power station; $21,000 for cost of the Essex Falls transmission line and equipment; $14,000 for equipment for sub-station at Essex Falls; $29,000 for new building and equipment of sub-station at Gloucester. Any excess in the proceeds of said stock over the amounts required for the above purposes shall be applied to the payment for permanent improvements and additions to the property. The value of the new shares at which they shall be offered proportionately to stockholders is $130 a share.

MORTGAGE.—The Grand Rapids, Holland & Lake Michigan Rapid Railway Company has filed a mortgage for $1,500,000 with the American Trust & Savings Bank, of Chicago, as trustee. The mortgage secures an issue of 750 bonds at $1,000 each and 150 bonds at $500 each. The money will be used in building a double track electric road from Grand Rapids to Macatawa Park.

STREET RAILWAYS.—The Massachusetts Board of Railroad Commissioners has authorized the Leominster & Clinton Street Railway Company to purchase the Fitchburg & Suburban Street Railway Company and to issue $188,000 additional capital stock. The Board has also authorized the Holyoke Street Railway Company to issue $85,000 twenty-year 5 per cent coupon bonds.

DIVIDENDS.—The Central Traction Company of Pittsburg, Pa., has declared the regular semi-annual dividend of 1½ per cent, payable Nov. 20. The Southern Light & Traction Company has declared a dividend of 1½ per cent, payable Nov. 20. Books close Nov. 10 and reopen Nov. 21.

Commercial Intelligence.

THE WEEK IN TRADE.—The result of the election and the more seasonable weather had a beneficial effect upon the situation in trade, the former event inspiring more hopefulness everywhere, and the latter stimulating very decidedly the distribution of heavy fall and winter goods. The feeling of confidence is especially marked in the South, and good are made from every other section. The best reports as to demand and prices come from the iron trade, and some heavy sales in crude material, rails and other manufactured products are reported. Wheat supplies are approaching a close parity with last year, and while the increase in stocks in the United States and Canada during the months of October was the smallest for seven years, the total supply is still larger than a year ago, by 4,000,000 bushels. In general gross railway earnings continue to show very satisfactory gains. On 60 roads the gross earnings for October aggregated $47,845,063, a gain of 3.5 per cent over October, 1899, a month of very large earn-

ings. Decreases are most notable in the Granger group, while bituminous coal roads, and the southwestern roads show the largest gains. The failures during the past week, as reported by *Bradstreet's*, aggregated 161, against 165 the previous week, 182 the same week last year, 187 in 1898, 273 in 1897 and 258 in 1896. The metal market showed more animation. In copper, while the market is still quiet and prices are unchanged, there is an evident tendency on the part of producers to hold out more firmly. Lake Superior ingot is quoted at 16¾c.; electrolytic and casting, 16⅝c.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York for the week just ended: Argentine Republic—30 cases electric machinery, $3,648; 260 packages electric material, $4,902. Antwerp—7 cases electric material, $1,573. Brazil—14 cases electric material, $1,273. British Australia—23 cases electric motors, $660. British West Indies—10 packages electric material, $153. Cuba—45 cases electric machinery, $2,797. Central America—67 packages electric material, $1,989. Chili—2 cases electric material, $58. Ecuador—1 case electric material, $41. Fiume—2 cases electric machinery, $206. Glasgow—187 cases electric material, $11,681; 1 case electric instruments, $70; 114 packages motor machinery, $3,950. Genoa —326 packages electric material, $31,252. Hayti—1 case electric material, $36. Havre—9 cases electric machinery, $775; 145 packages electric material, $3,621. Hamburg—196 cases electric machinery, $30,964; 30 packages electric material, $2,334 London—28 cases electric machinery, $3,176; 177 packages electric material, $14,247; 1 crate automobiles, $550; 16 boxes motors, $1,536. Liverpool—97 packages electric material, $10,000; 34 packages electric material, $2,996; 1 package trolley material, $18; 2 crates trolley wagons, $337. Leeds—6 packages electric material, $170. Mexico—107 packages electric material, $7,622. Milan—146 packages electric material, $12,056. Naples—455 cases electric material, $16,994; 20 cases electric machinery, $3,551. Newcastle—20 cases motor machinery, $4,000. Porto Rico—30 packages electric material, $997; 1 reel wire cable, $124. Peru—14 packages electric material, $788. Southampton—6 cases electric machinery, $650. U. S. Colombia—7 packages electric material, $380. Uruguay—4 cases electrical material, $131; 25 cases electric machinery, $540. Venezuela—37 packages electric material, $596. Vienna—35 cases electric machinery, $8,151. Zürich—7 boxes motor parts, $600; 7 cases electric material, $600.

THE AUTOMOBILE FUTURE is the subject of an interesting interview with Mr. Robert McAllister Lloyd, president of the Electric Vehicle Company, printed in the *Journal of Commerce*. He said: "Until recently American manufacturers of automobiles have been handicapped by reason of the fact that they have had to create a demand for their vehicles. In Europe there has been a market for some years, and it is not a question of whether one wants an automobile but whether he can afford to have it. The same has now come to be true in America, and from now on manufacturers can devote their entire time to filling the demand instead of working it up. The possibilities of the industry are almost unlimited. The advantages of the horseless vehicle can be mathematically demonstrated. This is particularly true of large cities, where space in streets is so important a factor in the rate of transportation. By getting rid of horses it is at once possible to place twice as many vehicles in the street as before without adding to the congestion. In addition to this, an automobile can go faster without increasing its rate of speed over that of horses because of the ease with which motor vehicles can be controlled and their ability to run closer to some impeding object in front. Then, too, the actual rate of speed can be somewhat increased, so that, with the same amount of room in the streets, it is possible to do probably three times as much business with automobiles, if not more, than with vehicles drawn by horses. Of course, there will have to be limits placed upon the rate of speed. A point that is worth noting in this connection, also, is the decreased wear and tear upon streets, and also the decrease in the expenses of street cleaning, two items which at present are important ones in the city budget." When asked as to the New York Electric Vehicle Transportation Company, in which he is a director, Mr. Lloyd said that the company had added to the number of its vehicles and would have between 300 and 400 in operation this winter, while it expected to operate 800 next summer.

SWISS AUTOMOBILES.—The following from the *American Machinst* is interesting: "Swiss dailies are praising the introduction of the automobile into the post office service in that country. The official trials have been very satisfactory and the introduction has been definitely decided. These automobiles are not only ambulant post offices on the order of our own railway service, but arrangements have been made to sell postage stamps, issue money orders and receipts and deliver registered mail to and from the automobile mail wagon. Next summer they will be found on a number of Alpine road routes now still covered by the medieval postal coach service." To this we may add that some American electrical engineers are now planning to run automobile stages over some of the best known routes in Switzerland, taking live current by flexible trolley from wires strung along the roads, and thus utilizing some of the waste water power. There is absolutely no reason why a horse or a ton of coal should be used in Switzerland for travel in those regions.

BELL TELEPHONE OUTPUT.—The American Telephone instrument statement for the month ending Oct. 20 is as follows:

	1900.	1899.		Changes.
Gross output	67,198	50,861	Inc.	16,337
Returned	30,737	18,044	Inc.	12,693
Net output	36,461	32,817	Inc.	3,644
Since Dec. 20:				
Gross output	524,362	539,598	Dec.	15,230
Returned	220,698	163,271	Inc.	57,427
Net output	303,664	376,327	Dec.	72,663
Total outstanding	1,884,169	1,501,577	Inc.	382,592

MACHINERY FOR GERMANY.—It is stated that large purchases of machinery are being made by the General Incandescent Arc Light Company to be shipped to Germany. Mr. S. Bergmann is conducting the purchasing. A short time ago Mr. Bergmann went abroad and established in Berlin the Bergmann Electric Equipment Company. It is said that Mr. Bergmann has disposed of his interest in the German plant and is now engaged in new operations. In Germany he has developed on a large scale the manufacture of interior conduit as well as that of the Burke dynamo electric generators and motors, some of which have been on view and in use at the Paris Exposition.

DRAWBACK LAW.—An interesting little pamphlet has been issued by Allen, Comstock & Co., of New York City, in which they point out that one method by which the cost of goods intended for the export trade can be materially reduced is to take advantage of the customs drawback law, under which a refund of the customs duties on imported materials is made when such materials are exported in the form of manufactured goods. This puts the American manufacturer on a par with his foreign competitor as to cost of raw material. Labor he is willing to pay for at a higher rate. It may be noted that electrical material is in the list of that on which such drawback has been granted recently.

HARBOR LIGHTS.—Tests are being made in Washington of storm warning lights to be placed on the new signal towers recently authorized by Congress to be established in the principal harbors of the country. While the maximum of the present carrying capacity is about five or six miles it is hoped to reach twelve miles at sea with the new oil lamps, and fifteen to eighteen miles with the electric lights in ordinary weather. American makers have protested against the award to foreign manufacturers, and Chief Moore of the Weather Bureau has decided that preference will be given to the American bidders, whose work is now so good.

RUSSIAN DEMAND FOR PHONOGRAPHS..—The United States Bureau of Foreign Commerce has received a letter from Mr. Emil Rothstein, of Rostov on Don, dated Oct. 21, 1900, requesting the names of manufacturers of phonographs and gramophones. Mr. Rothstein wishes to deal direct with American firms. Not desiring to discriminate between dealers, the Bureau takes this method of bringing the matter to the attention of those interested. The telegraphic address given is, Rothstein, Rostovdon.

TRADE WITH JAPAN.—The Japan-America Commercial & Industrial Association, of Tokio, Japan, has established an office in Cleveland, 908 New England Building, in charge of Mr. Frank Tange, a native Japanese. Mr. Tange will form Japanese connections for manufacturers of machinery and all kinds of manufactured products.

AMERICAN AGENCIES IN ENGLAND.—Messrs. Curtis & Roth, 23 Farringdon Avenue, London, England, desire to secure American electrical agencies for Great Britain. Both gentlemen have had considerable experience, and are in touch with the central electric light stations in England.

ELECTRIC RAILWAY CONTRACT.—The contract for the construction of the Indianapolis & Martinsville Electric Railway, in Indiana, has been awarded to the Dennis Construction Company, of Pittsburg. The road will be over 30 miles long, and the total cost is estimated at over $700,000.

DIRECT CONNECTED UNIT NEEDED.—The Pfister-Vogel Leather Company, Milwaukee, Wis., will remodel the Bay View tannery power house. A new generator, to be direct-connected to a Corliss engine, will be contracted for very soon.

THE NORTHERN ENGINEERING WORKS, crane manufacturers, Detroit, Mich., have recently shipped three motor electric traveling cranes to the Modern Steel Structural Company, Waukesha, Wis., and to the Wisconsin Bridge & Iron Company, Milwaukee.

ELECTRIC CRANES.—The Fort Pitt Bridge Works, Cannonsburg, Pa., have installed a "Northern" 10-ton 3-motor electric traveling crane, made by the Northern Engineering Works, of Detroit.

General News.

THE TELEPHONE.

MONTEREY, MEX.—The telephone company is replacing its single wires with insulated and protected cables.

CHICAGO, ILL.—The Continental Telephone Construction Company, capital $2,500, has been incorporated at Springfield.

CHESTER, OHIO.—The Central District Printing & Telephone Company (Bell) is installing an exchange in this place.

COUNCIL GROVE, KAN.—The Council Grove Telephone Exchange has a switchboard capacity of 160 drops, with 200 subscribers.

SEELEYVILLE, IND.—The farmers and merchants have contracted for a telephone line from this city to Bowling Green, via Poland.

MILWAUKEE, WIS.—The Wisconsin Telephone Company reports a net gain of 247 subscribers in October, making a total number of 20,029 subscribers on Oct. 31.

ST. CHARLES, MO.—The Kinloch Long Distance Telephone Company will extend its lines to St. Charles, and the Missouri River will be cabled at that point.

ROCHELLE, ILL.—The Ogle County Telephone Company is a flourishing corporation with 600 subscribers and prospects of 250 more. It operates an 800-drop board.

THE ERIE TELEPHONE SYSTEM made a net gain of 2644 subscribers in October. Total number connected Oct. 31, 137,214. The number waiting connection is 3177.

PRINCETON, MO.—The Harris & Princeton Telephone Company operates rented telephones. It contemplates building several toll lines to other counties. Mr. George is president.

PIPER CITY, ILL.—The Paxton Electrical Company informs us through Manager Montelins that it has a 100-drop board and 70 subscribers. It is building 20 miles of toll line.

MT. ALP, IA.—The Clearfield & Mt. Alp Telephone Company informs us that a larger switchboard with other improvements are projected. It has a 100-drop board and 105 subscribers.

PARKER, S. D.—We are indebted to the proprietor of the Parker Telephone Exchange for the following: A 100-drop board is operated, having 90 subscribers. The exchange expects an increase.

WILSON, N. C.—The Wilson & Carolina Telephone Company is extending its lines to Goldsboro, N. C. The company now controls about 200 miles of toll lines. H. F. Jones is general manager.

FLAGSTAFF, ARIZ.—The Flagstaff Mutual Telephone Company, Mr. Palmer, manager, has a 100-drop board and 73 subscribers. The company's progress has been fairly good and the outlook promising.

PLANT, TENN.—The Humphreys County Telephone Company operates a 50-drop board, with 35 subscribers. Mr. W. M. Stribling informs us that it contemplates local extensions and that the outlook is very good.

CARROLLTON, GA.—We are informed by Mr. J. G. Cheney, of Cheney & Mandeville, that they operate a 140-drop board and have 100 subscribers. A new switchboard is contemplated and the outlook is very good.

FORT SCOTT, KAN.—The Mutual Telephone Company has a 400-drop board and 343 subscribers. It has orders for further business and the prospects are very bright. Mr. F. H. Whitaker is constructing electrician.

HOLLY, MICH.—Both the Michigan Telephone Company and the Oakland County Telephone Company are preparing to install exchanges in this place. The Michigan Company has taken contracts for 60 telephones.

NASHVILLE, IND.—The new direct telephone line from this city to Columbus has been completed. This is the first telephone line for Brown County—the only county in the State without railway and telegraph facilities.

FAIRBURG, ILL.—We learn from Mr. G. L. Jacobs, of the Peoria & Eastern Automatic Telephone Company, that the company operates a 150-drop board with 120 subscribers, 35 being on party lines. A large increase is expected.

SPRINGFIELD, ILL.—The Illinois Telephone Construction Company, Chicago, has been incorporated. Capital, $2,500. Incorporators: H. Shafer, S. W. Moon, F. L. Bills, A. Stromberg, J. W. Blee, F. B. Patten, all of Chicago.

MOROCCO, IND.—The Dixon Telephone Company operates two boards, with 200 drops and expects to enlarge one. At present the number of subscribers is 190. Recent growth has been very large and the outlook is extremely good.

MILWAUKEE, WIS.—The Milwaukee Harvester Company has awarded a telephone contract to the Stromberg-Carlson Telephone Manufacturing Company, of Chicago. The contract is for a 50-station central energy system.

CHATTANOOGA, TENN.—The East Tennessee Telephone Company will, it is stated, extend its lines into Georgia and Alabama and connect with the Bell Company. A. D. Powell becomes manager of the exchange at Chattanooga, Tenn.

CARLINVILLE, ILL.—The Central Union Telephone Company is building a new toll line into the city, and expects to have it completed by the middle of November. The new line will pass through Gillespie, Bunker Hill and Bethalto to St. Louis.

BARABOO, WIS.—The manager of the Baraboo Telephone Company, Mr. W. J. Bell, informs us that the company has a switchboard capacity of 320 city and 25 toll-line drops. It has 80 miles of toll line and 458 subscribers, and the number is steadily increasing.

HOUSTON, TEX.—All of the union employees of the Southwestern Telegraph & Telephone Company in this city went out on strike on Nov. 5. It is stated that the strike is largely a sympathetic one in behalf of the union strikes at Waco and San Antonio.

CITY OF MEXICO, MEX.—The Governor of the State of Tabasco, Mexico, has issued an order that the telephone lines system in that State shall be immediately extended from Chontapla del Paraiso to Ceiba and Dos Bocas, the latter town being located on the seacoast.

INDIANAPOLIS, IND.—The Northern Indiana & Southern Michigan Telephone Company has filed articles of incorporation. Capital, $20,000. Directors: A. J. Hastetter, Rolin Ellison and Alice Ellison. The company will construct a plant and operate in Elkhart and counties adjoining.

SPRINGVILLE, N. Y.—Mr. Brooks, president of the Springville Telephone Company, informs us that his company is just incorporated and has not yet commenced operations. It has a 50-drop board capacity and over 100 subscribers, with 30 miles of metallic circuit. Extensions are projected.

JACKSON, MICH.—Two years ago the new State Telephone Company secured a franchise for the construction of a local exchange, but it failed to live up to the conditions of the grant. Recently the company forfeited a $1,000-bond and interest thereon, the money being turned into the city treasury.

BLACK RIVER FALLS, WIS.—The Wisconsin Telephone Company has a crew of about 40 men at work on the construction of the long distance line from La Crosse to Eau Claire. These men will work toward Eau Claire. The company also has a crew working from La Crosse toward Black River Falls.

COLUMBIA, S. C.—A company, with half a million capital, has been started for the purpose of operating independent telephone lines in South Carolina. Samuel L. Miller, of Columbia, S. C., is one of the incorporators. The organization is to be known as the South Carolina Long Distance Telephone Company, of Columbia, S. C.

BLACK ROCK, ARK.—The lines operated by Anderson & King were originally private, but pressing public demands have rendered it advisable to open them to the public. They operate five boards of 30, 25, 10, 10 and 5 drops, and have about 100 subscribers. New lines are projected and orders for service are received so frequently as to tax the capacity of the working staff.

RICHMOND, VA.—It is stated that the new Richmond Telephone Company will oppose the granting of a franchise to the Southern Bell Telephone Company. A representative of the new company states that when its charter was obtained it was tacitly understood that the Bell Company would not be granted a franchise. It is possible that the Bell may attempt to secure a controlling interest in the new company.

JACKSON, MICH.—The Michigan Telephone Company has applied for permission to rebuild its exchange, placing wires in underground conduits. It is proposed to install new switchboards, giving an ultimate capacity of 3600 drops. The company agrees to make the following rates: Business, full metallic, $48; common line, $24. Residence, full metallic, $36; common line, $18. Two-line telephones, $12. Rural party line for a distance of six miles, $12.

ELECTRIC LIGHT AND POWER.

GREEN COVE SPRINGS, FLA.—The Magnolia Hotel Company will install an electric lighting plant.

LAUREL, LA.—The city has granted a franchise to F. W. Pettibone, who will build an electric light and power plant.

VICKSBURG, MISS.—The Southern Light & Power Company has been organized, with a capital stock of $100,000.

TULLAHOMA, TENN.—The City Council will pass an ordinance granting an electric lighting franchise to a private company.

CITY OF MEXICO, MEX.—A new electric light plant is being installed in the town of Zacoalco, in the State of Jalisco, Mexico.

MAYENNE, FRANCE.—A municipal electric lighting plant is to be established in this city at a cost of 102,000 francs ($20,400).

INCREASE OF CAPITAL.—The Hartford Electric Light Company, Hartford, Conn., has increased its capital stock to $1,050,000.

LADYSMITH, NATAL.—The General Council has decided to light this place by electricity and specifications for a suitable plant are now called for.

MONROE, GA.—The city is negotiating for the purchase of the water works and electric light plants, and if not successful may construct municipal plants, for which it has $60,000 available.

CARLETON PLACE, ONT.—Mr. G. A. Burgess, of Carleton Place, is forming a company to engage in the electric lighting and power business in that town. It is proposed to utilize the water-power at Arklan.

WOODSTOCK, ONT.—The Woodstock (Ont.) Electric Light Company offers to sell its electric light plant to the town of Woodstock for $14,000, but the town will not pay a greater price than $13,000.

HARRISBURG, ILL.—The boiler at the electric lighting plant exploded here Nov. 1, so completing wrecking the machinery that it will have to be replaced entirely. The city will be in darkness for a month to come.

SHELBY, N. C.—The Shelby Electric Light & Power Company will build an electric light and power plant. The company has leased water-power three miles from Shelby, and will later on install a steam plant for emergency use.

OELWEIN, IA.—The Oelwein Light, Heat & Power Company has been incorporated. Capital, $100,000. Incorporators: J. E. Hartenbower, of Illinois; J. Jamison and W. Walker, both of Oelwein; B. D. Hurd, of Des Moines.

MUNCIE, IND.—Injunction proceedings have been brought against the Heat, Light & Power Company, of this place, asking for a restraining order to protect the people from a new rate, claimed to be exorbitant, for heat and light.

AUBURN, IND.—This city claims the distinction of being the best lighted in the State. The city put in its own electric light plant. The plant is large, and negotiations are pending to furnish current to light the town of Waterloo, four miles distant.

EGG HARBOR CITY, N. J.—The City Councils have awarded the street lighting contract to the Egg Harbor Electric Light Company. The company will furnish 23 2000-cp arcs and 10 16-cp incandescents at $15.90 a year for 10 years. The plant will be remodeled as soon as possible.

SHEFFIELD, ENGLAND.—The electric lighting plant of this city is to be extended and new machinery added to the value of $115,000. Other material will be required costing $25,000, and another new plant is projected to cost about $10,000, exclusive of building. Mr. Robert Hammond, 64 Victoria Street, London, is consulting engineer.

FOSTORIA, OHIO.—As the result of an investigation by the city solicitor because of the excessive increase in the price for lighting made by the City Heat & Light Company, it was found that the city had the right to regulate the price for incandescent lights. A committee was appointed by the Council to fix a reasonable price, which will be enforced.

ALBANY, N. Y.—The Westchester Lighting Company, Port Chester, has been incorporated. Capital, $2,500,000. Incorporators: C. W. Squires, C. H. Werner, R. F. McKiniry, N. D. Daboll, M. J. Warner, R. H. Giles, all of New York City; L. B. Grant, C. M. Hemingway, H. A. Kenworthy, all of Brooklyn; Sheehan & Collin, attorneys, New York City.

SAN FRANCISCO, CALIF.—The U. S. army transport Sheridan has received repairs and many alterations in San Francisco at a cost of $200,000. An additional house has been built on the main deck to accommodate the electric generating plant. A 600-light generator was added to the electric equipment. The Fulton Iron Works had the contract for the repairs.

OTTAWA, ONT.—Messrs. Ahern and Soper, of Ottawa, have purchased the water power on the Ottawa River known as the Little Chaudiere, the consideration being $6,500. It is understood that it is the intention to develop the water power at an early date. It is expected that the firm will be able to develop about 10,000 horse-power, which will be used for manufacturing purposes.

SPRINGFIELD, OHIO.—Bids were opened by city officials a few days ago for electric street illumination. It was found that the Springfield Light & Power Company had a competitor in the Fort Wayne Electric Works, of Fort Wayne, Ind. The local company bid as follows: Three-year contract, $88.45 per lamp up to 300; $87.45, in excess of 300. Five-year contract, $84.75 and $82.75. Ten-year contract, $76.85 and $76.85. The Fort Wayne Company made a straight bid of $79 per lamp per annum on a 10-year contract, the city to give the company a franchise and allow it six months' time to equip a plant. The price paid the local company at present is $89 per lamp.

THE ELECTRIC RAILWAY.

GAFFNEY, S. C.—The town of Gaffney has voted $15,000 additional bonds to improve the electric light and water systems.

NEWPORT NEWS, VA.—The Hampton Roads Railway & Electric Company, of Newport News, Va., has been granted a franchise.

SAN ANTONIO, TEX.—The Alamo Heights Electric Street Railway, of this city, was disposed of at receiver's sale on Nov. 1.

GREENVILLE, S. C.—A seven-mile electric railway will be built by the new Greenville Electric Railway Company. D. H. Whitner will survey the route.

MARSHALL, TEX.—A. W. Wheeler has applied to the City Council for a franchise for an electric railroad in this place. The application will probably be granted.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company will issue $1,750,000 in bonds, which, it is stated, will be expended for various improvements to its lines.

RICHMOND, VA.—The Traction Company has accepted the proposition of the Richmond Passenger & Power Company for a system of transfer. The suburban lines were not included in the arrangement.

LAREDO, TEX.—The electric street car system in this city, which has been in operation for the past eight years under the management of C. F. Yeager, suspended business on Oct. 15, owing to lack of patronage.

BUFFALO, N. Y.—The International Rapid Transit Company, of this city, has been incorporated in Ontario. The company has in view the connection of Fort Erie, Crystal Beach and Niagara Falls by an electric railway.

OTTAWA, ONT.—The Lundy's Lane & Stamford Electric Railway Company has asked for a franchise to build an electric railway from Niagara Falls, Ont., to Thorold. W. C. Poole, civil engineer, of Buffalo, and F. W. Griffith, of Niagara Falls, are interested in the project.

STREET CAR STRIKE IN JAMAICA.—A strike of the employees of the Canadian-American Street Railroad at Kingston, Jamaica, W. I., is serious. The service is almost at a standstill. A few cars are running under police protection and a strong police force has been called out to guard the works from assault.

ELKTON, MD.—The directors of the Cherry Hill, Elkton & Chesapeake City Electric Railway have decided to construct the line between Elkton and Chesapeake City without the aid of the State of Maryland in a subscription to the stock to the amount of $58,000. As empowered, the company will issue stock to the amount of $150,000, $60,000 of which has already been subscribed.

NIAGARA FALLS, ONT.—The surveys and plans for the proposed electric railway from Niagara Falls to Fort Erie, on the Canadian side, have been completed, and preparations are being made to proceed with construction this winter. The road will be built along the water's edge, will be 20 miles long and constructed for fast service. Mr. C. H. Mitchell, of Niagara Falls, is the engineer.

PARKERSBURG, W. VA.—The Fairmont & Clarksburg Electric Railway has organized here by the election of the following directors: J. N. Camden, Sprigg D. Camden and Isaac D. Davis, of Parkersburg; Gov. A. B. Fleming, of Fairmont; J. A. Flickinger, of Monongah; Herbert R. Preston, Baltimore, and E. R. Bacon, New York. J. N. Camden is president and Sprigg D. Camden secretary and treasurer.

LEGAL.

CLEVELAND, OHIO.—Judge Lamson, of the Common Pleas Court, Cleveland, has granted a perpetual injunction against the execution of the contract recently made by the city of Cleveland with the Gamewell Fire Alarm Telegraph Company for the construction of a new police signal system. The petition for an injunction was filed by the city director of law on the ground that testimony given in the councilmanic bribery investigation had tended to show that the awarding of the contract by the Council had been influenced by corrupt methods. Judge Lamson, in rendering his decision, severely scored members of the City Council whose names have been mentioned in connection with the scandal.

INDIANAPOLIS, IND.—The Supreme Court has decided that where a city grants permission to erect poles and wires in its streets for the purpose of lighting the city by electricity, and expressly reserves the right to revoke the grant and compel the removal of the poles, or remove them if necessary, its officers are not liable in damages for ordering the owner to remove the poles, when his contract expires, to make way for a system of lights belonging to the city, nor for removing them in a proper manner if he refuses to do so. This ruling is in reversal of a judgment for $4,000 recovered by John D. Edwards against the officials and city of Decatur, Ind., for damages on account of tearing down his poles and wires and thereby destroying his electric light plant at that place.

THE SELDEN AUTOMOBILE PATENT.—Judge Coxe, in the United States Circuit Court, Southern District of New York, has overruled the demurrer to the bill of the Electric Vehicle Company and George B. Selden vs. the Winton Motor Carriage Company, Percy Owen and A. W. Chamberlain. The judge's opinion, in full, follows: The bill, in the usual form, is based upon letters patent No. 549,160, granted Nov. 5, 1895, to George B. Selden, for a road vehicle, the motor being a liquid hydrocarbon gas-engine of the compression type. The application was filed May 8, 1879. The demurrer, though divided under five separate heads, is based upon the broad proposition that the patent, on its face, is void for lack of patentability. Stated generally the argument for the defendants is as follows: The specification concedes that all of the elements of the combinations of the claims were old; that steam engines were employed to propel road wagons, liquid fuel being used to generate steam; that gas engines were old and their use, as well as that of other motors, had been proposed for tram cars and similar vehicles. This being the admitted state of the art it is argued that it did not require an exercise of the inventive faculty to substitute a gas-engine for a steam-engine in a well-known self-propelling vehicle. It is insisted, further, that the claims do not cover combinations, but are for aggregations merely. The law is very plain. A patent must not be held invalid upon demurrer unless its invalidity so clearly appears that no testimony can change the legal aspect of the case. If doubt exists the complainant is entitled to its benefit; if the faults pointed out by the defendant may, by any chance, be cured by proof; if, in short, there be a possibility that the complainant may succeed, the demurrer should be overruled. Am. Fibre Co. v. Buckskin Co., 72 Fed. Rep. 508. It should be remembered that the invention, if there be one, was made very early in the history of "horseless carriages." The court will take judicial notice that prior to May, 1879, the art of propelling vehicles by motors, carried by the vehicle itself, was in its infancy. These carriages were unknown to the streets of New York and few were seen on the streets of Paris. They were, without exception, crude and tentative machines. Selden must, therefore, have been among the earliest experimenters in the art. If the thousands of steam and electric "automobiles" which now are constantly perambulating the streets of every large city had been available as models the task of constructing a successful "gasmobile" would have been less difficult. In other words, the fact that Selden's work was done over 21 years ago should not be lost sight of in estimating the value of his achievement. Upon the present record he must be regarded as the first to construct a road-locomotive provided with a liquid hydrocarbon gas-engine of the compression type so arranged as to leave the platform of the carriage unobstructed. The drawings of the English patents referred to show locomotives designed to run upon rails and, therefore, presumably, upon levels or light grades. This was not the problem which was solved by Selden. He has made, or it must, on demurrer, be assumed that he has made, a self-propelling vehicle, which is capable of traveling on ordinary country roads, going up and down hill, and making long distances without replenishing its fuel receptacle. Surely, it required invention to construct such a machine. But in order to test the proposition still further let it be assumed that steam carriages and electric carriages similar to those in common use to-day were known prior to 1879 and that gas motors had actually been used to propel, upon common roads, the heavy and clumsy structures shown in the drawings of the English patents. This statement of the prior art assumes three most pregnant facts not found in the record, but, even so, how stands the case? It is fair to assert that in no circumstances, could it involve invention to create the patented machine because similar machines had been propelled by electricity and steam, and machines, differing radically in structure and purpose, had been propelled by gas? Was there nothing more than the new application of an old device to a well-known class of vehicles? It is thought that the complainants are entitled to a more liberal interpretation of the patent than that contended for by the defendants. The patentee's contribution to the art should not be considered from a narrow point of view; his work should not be examined through an inverted telescope; the horizon of invention should not be contracted to the periphery of a sixpence. The patent described an ingenious and complicated machine operated by a type of engine never used before in road locomotives, employing with safety a highly volatile and dangerous fluid. The carriage of the patent is easily handled; it economizes space and may be managed by one possessing no expert knowledge. It cannot be maintained, upon the English specifications alone, that the construction of such a machine required no inventive skill. It is possible, if not probable, that a light road carriage equipped after the English plan would prove a lamentable failure. The doctrine invoked by the defendants, that the transfer of an old device to a new use does not involve invention, if applied without qualification or exception, would destroy many of the most valuable patents. See Potts v. Creager, 155 U. S. 597. At pages 606 and 607 the court discusses a large number of situations in which the rule is inapplicable and concludes with the following pertinent observation: "Indeed, it often requires as acute a perception of the relation between cause and effect, and as much of the peculiar inventive genius which is charactristic of great inventors, to grasp the idea that a device used in one art may be made available in another, as would be necessary to create the device *de novo*." The court is clearly of the opinion that the immense weight of authority sustains the proposition that this patent cannot be held invalid on demurrer. The court has refrained from discussing the subsidiary questions mooted on the briefs as they may appear in a totally different light after the proof is presented. The demurrer is overruled, with costs. The defendant may answer in 20 days.

OBITUARY.

D. C. BUNNELL.—Dewitt C. Bunnell, son of the late J. H. Bunnell, and secretary of the Bunnell Telegraphic & Electrical Company, New York, died at his home in New York on Nov. 11, of typhoid-pneumonia. The remains were buried in Greenwood Cemetery on Nov. 14. Mr. Bunnell was in his 24th year.

C. H. HOOPER, for a long time identified with the Gregory Electric Company in its accounting department, died very suddenly at Phœnix, Ariz., on Oct. 31. He left Chicago in September for Phœnix hoping to recuperate, and was reported as gaining rapidly. A cold caught on the day of his death was too severe, however, producing congestion of the lungs, from the effects of which he died. He was born at Rutland, Ohio, but was buried at Phœnix, where he had relatives. Mr. Hooper was universally liked, and his death is sincerely mourned by all who knew him.

F. J. PATTEN.—Lieut. Frank Jarvis Patten, vice-president of the Columbia Carbide Company, at 31 and 33 Broadway, of which James E. Campbell, former Governor of Ohio, is president, died suddenly in his bedroom in New York City on Nov. 12. He had been in broken health for some time. Mr. Patten was born in Bath, Maine, 48 years ago, and was the son of a former Commissioner of Patents. He began his education in that city and afterward went to West Point. He was also educated in Germany. While in the army he participated in the Nez Percés campaign and was aide to General Howard. He experimented with electricity while still in the army and left it to pursue his studies. He invented an ingenious multiplex telegraph system and a company was formed to exploit it. The carbide company, of which he was vice-president, was formed by his personal friend, James E. Campbell, to exploit Mr. Patten's invention for the manufacture of carbide. Just before his death Mr. Patten was at work upon an invention he called "a position finder" for ships, and several other devices.

PERSONAL.

MR. L. B. STILLWELL has been appointed electrical director of the Rapid Transit Subway Construction Company.

MR. FRANK HOWARD, superintendent of the Standard Electric Light Company, Avoca, Pa., was married on Oct. 24 to Miss Grace Lansing, of Corning, N. Y.

MR. CHARLES D. WEAVER, assistant district foreman for the C. D. & P. Tel. Company, of Greensburg, Pa., has resigned and accepted a position with the Pittsburg & Allegheny Telephone Company, of Pittsburg.

MR. CHARLES EDWARD SKINNER, of Pittsburg, Pa., representing the electrical engineering department of the Westinghouse Electric & Manufacturing Company, is making a trip through Mexico in the interest of that concern.

BALDWIN-WARNER.—Mr. J. E. Baldwin, a well-known former electrical contractor of New York City, was married on Nov. 3 to Miss Agnes M. Warner, of East Williston, L. I. Mr. Baldwin is now associated with the Ideal Fuel-Feeder Company, Brooklyn Borough, and has a wide business and executive ability.

MR. JOS. H. WILLIAMSON, who for nearly 18 years has been the business manager of the Manufacturers' Advertising Agency, New York City, has severed his relationship with that company to connect himself with the old-established Viennot Advertising Agency, 524 Walnut Street, Philadelphia, as its business manager in the place of Mr. Thompson, resigned. Mr. Williamson is well known in the trade paper and general advertising field, and will be glad to welcome all his old friends at any time at his new address, either at the office in Philadelphia, or at the New York office of the Viennot Agency, 127 Duane Street, Graham Building.

Trade Notes.

MODERN RAILWAY SHOPS.—The Northern Pacific Railroad Company will build new shops at Brainerd, Minn., the steel work of which will be furnished by the American Bridge Company.

THE WEST COAST ELECTRICAL WORKS recently started in business at 158 New Montgomery Street, San Francisco, Calif. They will conduct a business as supervising and electrical engineers.

THE AMERICAN TIN PLATE COMPANY, of Chicago, Ill., has repeatedly duplicated its orders for Cross oil filters and is now using 19 filters in its plant. This speaks well for the popularity of the Cross.

SKEPTICISM.—The Electric Appliance Company, Chicago, has in press a little book, entitled "Skepticism," written especially for those who have doubts as to the claims made for the Gutmann wattmeter.

J. B. McKEAGUE & COMPANY, 324 Dearborn Street, Chicago, have issued a catalogue of the electrical measuring instruments and supplies of which they are the manufacturers' agents and wholesale jobbers.

NATIONAL ELECTRICAL CODE.—The October, 1900, edition of the supplement to the National Electrical Code is now ready for distribution. Copies can be obtained by addressing Mr. W. H. Merrill, Jr., 67 East Twenty-first Street, Chicago.

STEREOPTICON CATALOGUE.—The Charles Besler Company, 251 Centre Street, New York, illustrates and briefly describes its line of stereopticons and accessories and other instruments. The catalogue contains 64 pages and is neatly gotten up.

MANUAL OF ELECTRICAL UNDERTAKINGS.—The fifth edition of "Garcke's" manual of electrical undertakings, published in London, England, has been issued. This work contains general information and particulars relating to over 1250 electrical undertakings.

MICA.—The Asheville Mica Company, Asheville, N. C., informs us that it has lately found a mica bed in that section that is very nearly as soft as the Canadian amber mica. Prospecting indicates that the field is large and capable of producing great quantities of the mineral.

DRESES, MUELLER & COMPANY, of Cincinnati, report that, in spite of the somewhat depressed conditions existing in the machine-tool industry, their business is steadily increasing, the demand for their radial drills and turret lathes having been unusually large during the month of October.

COLUMBIA BLOTTER.—The Columbia Incandescent Lamp Company, St. Louis, Mo., is distributing desk blotters containing, on the back, an illustration of a 16-cp Columbia lamp, together with some facts concerning the company's product. The company will be glad to send blotters to any one making request by mail or otherwise.

AUTOMOBILE CATALOGUE.—Mr. Charles E. Miller, 97 Reade Street, New York, has just brought out a special automobile catalogue. It is one of the most complete catalogues of automobile material ever produced. It was distributed from the Miller booth during the Automobile Exhibition at Madison Square Garden last week.

EMERSON BULLETINS.—Additions to the trade literature of the Emerson Electric Manufacturing Company, St. Louis, Mo., consist of three bulletins—Nos. 3022, 3023 and 3024—on "Electric Pumps for Deep Wells," "Electric Coffee Mills" and "Standard Manufacturing Sewing Machines." All of these devices are shown operated by Emerson alternating-current motors.

"THE WORLD'S WORK" is the name of a new magazine issued monthly by Doubleday & Page, of New York City. It is an admirable production, broad, well written, strongly edited, finely illustrated and dealing with all the topics that can interest any man of thought and action. It deserves and will secure a host of readers from the best elements in the community.

THE CENSUS OF 1900.—A booklet, giving the population of all cities of the United States of 25,000 and over according to the census of 1900, has just been issued by the passenger department of the Chicago, Milwaukee & St. Paul Railway, and a copy of it may be obtained by sending your address, with two-cent stamp to pay postage, to the General Passenger Agent of the Chicago, Milwaukee & St. Paul Railway, Chicago, Ill.

POLITICAL ELECTRIC ILLUMINATION.—The Norden Electric Works, 149 West Twenty-eighth Street, New York, installed the lighting equipment at the Dewey Arch, Madison Square, for the political demonstration of Oct. 27 last. The decorations were very effective and attracted considerable attention. There were installed 6000 16-cp lamps on the arch and colonnades. The current was furnished by the Edison Electric Illuminating Company.

ELECTRICAL SUPPLIES.—Messrs. E. E. Cary and G. A. Powell, of St. Catherines, Ont.; N. L. Henderson, S. F. Washington and W. E. Boyd, of Hamilton, Ont., have been incorporated by the Ontario government under the name of the Hamilton Electric Supply & Construction Company. The new company starts out with a capital of $40,000, and proposes to deal in electrical supplies and to install electric plants. The head office is in Hamilton, Ont.

NEW FACTORY.—Milwaukee Electric Company, Milwaukee, Wis., has decided to build a new factory which will employ 300 to 500 men. This step the company finds necessary, as its present quarters are far too small to handle the rapidly increasing business. The new factory will cost approximately $25,000. The Milwaukee Electric Company was organized only about a year and a half ago, but its dynamos and motors have found favor in all parts of this country.

PUMPING MACHINERY.—The Kilby Manufacturing Company, of Cleveland, Ohio; the E. P. Allis Company, of Milwaukee, and the Holly Manufacturing Company, of Lockport, N. Y., have bid on four 30,000,000-gallon pumping engines for the Cincinnati water works department; also for an electric traveling crane. The figures of the three concerns, in their respective order, are as follows: $819,350 and $10,000; $1,044,000 and $11,000, and $987,700 and $10,000.

REMOVAL NOTICE.—The Chase-Shawmut Company, Boston, Mass., announces the removal of its office and factory from 161 Fort Hill Square to the Atlantic Building, 390 Atlantic Avenue, where it has the best of facilities for manufacturing and prompt shipment. The company's plant has been largely increased to take care of the rapid demand for its various specialties. With its machine shop it has a finely equipped department for the repair of motors and dynamos.

THE ELGIN ADJUSTABLE WRENCH, handled by the Western Electric Company, is one of the handiest wrenches on the market. It is easily and accurately adjusted and has an exceedingly wide range of usefulness. It will hold pipe, nipples, collars, rods and square, hexagonal or round nuts, making it very useful to blacksmiths, plumbers, gasfitters, engineers, electricians, machinists and implement men. It is nicely proportioned, well finished and fully nickel-plated, made of steel with hardened jaws, is seven inches long and weighs 10 ounces.

ELECTRIC HOISTS AND CONVEYORS.—The Browning Engineering Company, Cleveland, is erecting near Collinwood, Ohio, a large plant for the production of electric hoisting and conveying machinery. Twelve acres of land were donated by Collinwood real estate people, one of the conditions being that the company is to employ not less than 700 men. B. F. Miller, former vice-president of the National Carbon Company, Cleveland, is president of the new company; V. R. Browning, vice-president, and E. H. Browning, secretary.

MR. ELMER G. WILLYOUNG, the well-known instrument manufacturer and specialist, 82 and 84 Fulton Street, New York, reports enjoying brisk and satisfactory business. His new cable-testing sets are attracting considerable attention. Orders for them have just been filled for for the Knickerbocker Telephone Company, National Conduit & Cable Company and New York & New Jersey Telephone Company. Mr. Willyoung also furnished a considerable equipment of testing instruments for the testing room of the U. S. cable ship Burnside, which sailed recently for Manila. A new line of X-ray coils has just been put on the market by Mr. Willyoung. These coils have independent vibrator, adjustable condenser and interlocking switch, and are made for either battery or power circuits. The characteristic of the new coils, which are known as "Type H," is the large cross-section of the secondary wire, which enables an exceedingly heavy discharge to be drawn from the secondary. A complete 15-in. power outfit of this type is now being installed in the Roosevelt Hospital, New York City; a similar 12-in. outfit goes to the Oil City Hospital, Oil City, Pa., and a 10-in. outfit to the All Souls' Hospital, Morristown, N. J. An elaborate 32-page catalogue of the Willyoung X-ray apparatus, as also a number of smaller catalogues covering the subject of cable-testing and photometric apparatus, as also several new forms of galvanometers, has been issued and is free for the asking.

CHANGE OF STYLE.—The business of Mr. Arthur L. Bosley, Baltimore, Md., is now being conducted in the name of the Electrical Material Company. The company deals in general electrical supplies.

RAINBOW PACKING.—The results of using poor packing and gaskets and the advantages of using "Rainbow" packing and Eclipse gaskets are well illustrated in a large folder being distributed in the trade by the Peerless Rubber Manufacturing Company, 16 Warren Street, New York. The facts set forth and the testimonials given ought to be of deep interest to every engineer.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED NOV. 6, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

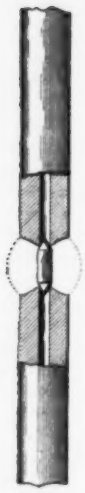
661,049. CONTROLLING END PLAY OF ROTARY MACHINES; E. M. Hewlett, Schenectady, N. Y. App. filed Aug. 31, 1900. (See Current News and Notes.)

661,085. PROCESS OF MAKING ACCUMULATOR PLATES; Zdzislaw Stanecki, of Lemberg, Austria-Hungary. App. filed Nov. 9, 1899. Litharge and red lead are mixed to a paste with distilled water, then shaped into a slab, then slowly dried with repeated moistening with water. After complete drying and incrustation with hydrate of lead, the hardened slab is immersed in dilute sulphuric acid.

661,107. CARBON PENCIL FOR ELECTRIC LIGHTS; J. F. Sanders, Chicago, Ill. App. filed Sept. 25, 1899. The two pencils are held apart by a short plug of indestructible material around which the arc is formed between the ends of the pencil. The carbons are fed to compensate for consumption by the weight of the upper pencil and without the aid of mechanism.

661,116. RHEOSTAT AND CIRCUIT BREAKER; W. M. Scott, Philadelphia, Pa. App. filed Sept. 28, 1899. This invention is intended to provide that during the cutting out of resistance, the circuit breaker shall withstand a greater amount of flow without being actuated than it will stand after said resistance is cut out. This is accomplished by short-circuiting a portion of the actuating coil during a prescribed movement of the resistance controlling switch.

661,123. ELECTRIC ARC LAMP; J. A. Heany, Philadelphia, Pa. App. filed Feb. 27, 1900. The features of novelty include the use of the resistance coil as an aid to the main solenoid and the confining of the arc and feeding mechanism, except the coil, in a sealed chamber.



661,107.—Carbon Pencil or Electrode for Electric Lights.

661,126. ELECTRIC ARC LAMP; J. A. Heany, Philadelphia, Pa. App. filed Feb. 27, 1900. An improvement on the preceding patent.

661,127. ELECTRICAL MEASURING INSTRUMENT; F. A. LaRoche, New York, N. Y. App. filed Aug. 22, 1900. This invention relates to the construction of the magnet poles with a view to facilitating the adjustments of the calibrated scale.

661,165. PROTECTING UNDERGROUND METALLIC STRUCTURES FROM EFFECTS OF ELECTROLYSIS; L. I. Blake, Lawrence, Kan. App. filed Aug. 9, 1900. (See Current News and Notes.)

661,173. ELECTRIC CALL OR SIGNAL BOX; G. G. Glenn and W. S. Sullivan, Philadelphia, Pa. App. filed April 20, 1900. This is a messenger system provided with switching devices whereby the same line may be used for telephonic purposes.

661,188. PROCESS OF SEPARATING METALS FROM THEIR COMBINATION; A. Nettl, Prague, Austria-Hungard. App. filed Dec. 28, 1897. The process consists in causing a mercury electrode to continually fall freely in a plurality of finely divided streams through an electrolyte and passing a current to the mercury as a cathode through an electrolyte containing a metal capable of combining with such mercury cathode.

661,195. AUTOMATIC MAGNETIC CIRCUIT BREAKER; W. M. Scott, Philadelpha, Pa. App. filed July 22, 1899. Means are provided for insuring the opening of a main switch prior to the opening of a shunt switch and the closing of the main switch subsequent to the closing of the shunt switch.

661,222. METHOD OF GOVERNING PRIME MOVERS; R. D. Mershon, New York, N. Y. App. filed Nov. 6, 1899. (See Current News and Notes.)

661,224. TELEPHONE ARM; H. McDonald, Williamsport, Pa. App. filed Dec. 13, 1899. This is a hollow arm provided with slots at the pivot permitting of the introduction of wires without interfering with the movement of the arm.

661,227. COMMUTATOR COLLECTOR; Henry G. Reist and Edward L. Aiken, of Schenectady, N. Y. App. filed June 26, 1898. A commutator for alternating-current machines, consisting of an arbor upon which the collector rings and commutator are mounted in such a manner as to be readily removable and taken apart for repairs. Stated to be particularly applicable for rectifying commutators.

661,228. ADJUSTING BRUSH-HOLDERS; Henry G. Reist, of Schenectady, N. Y. App. filed March 22, 1900. As illustrated, the brush-holder support is mounted independently of the machine, and consists of a tubular standard, the upper end of which has a split tubular aperture for the reception of the shank of a brush-holder. A rubber bushing provided with a shoulder is fitted within the tubular support, the shoulder resting on the upper end of the support. A bolt clamps the brush-holder within the split tube after it has been inserted in the rubber bushing, the clamping position being adjustable.

661,229. ELECTRIC BURGLAR ALARM SWITCHBOARD; S. H. Rickard, West Bridgewater, Pa. App. filed Sept. 16, 1899. Relates to mechanical features of the board.

661,241. THERMAL CUT-OUT OR FUSE; Otto Feuerlein, of Charlottenberg, Germany. App. filed Sept. 9, 1899. An enclosed fuse with an auxiliary or detector shunt of high resistance which is visible through an opening when the fuse is not blown.

661,244. ELECTRIC CABLE; W. M. Habirshaw, New York, N. Y. App. filed Sept. 26, 1900. One or more conductors, each enclosed in a paper covering, laid down in a bed of fibrous material, the whole being surrounded by a layer of vulcanizable rubber.

661,260. TRANSMITTER; R. H. Fergerson, Baltimore, Md. App. filed Aug. 15, 1900. Details of a telephone instrument.

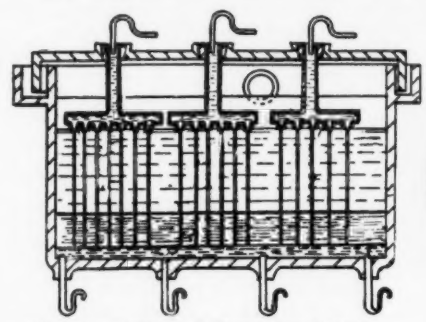
661,292. DYNAMO ELECTRIC MACHINE; J. F. Kelly, Pittsfield, Mass. App. filed May 11, 1900. (See Current News and Notes.)

661,306. DYNAMO ELECTRIC MACHINE; C. C. Chesney, Pittsfield, Mass. App. filed May 11, 1900. (See Current News and Notes.)

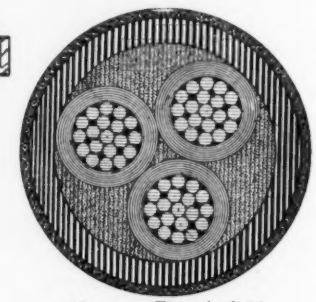
661,340. MEANS FOR ELECTROLYZING LIQUIDS; A. R. Grever, Philadelphia, Pa. App. filed May 19, 1900. A pair of electrodes placed in a liquid conduit are connected in a circuit which is controlled by the valve controlling the flow of liquid.

661,385. APPARATUS FOR DETERMINING THE POSITION OF FOREIGN BODIES BY MEANS OF RÖNTGEN RAYS; Charles Remy, of Paris, France. App. filed Sept. 28, 1899. Below an operating table is mounted a rod with two positions for a Crookes tube. Above the table and patient is a diffusing screen on which the shadow of the foreign body is thrown, and above this is a plate with two slots, said slots being circular and struck from the focus of the Crookes tube in its two extreme positions; in the slots move ferrules carrying rods whose axes pass through the same foci. One rod is fixed to touch the shadow of the object with the tube in one position, and the other to touch the shadow when the tube is in the other position; the screen then being removed and the rods lowered to the body of the patient, the situation of the object is indicated.

661,448. ELECTRIC TRACTION OF TRAINS OF VEHICLES UPON RAILS; Lucien Gentry, of Marseilles, France. App. filed May 3, 1900. A system whereby a single attendant can control at a distance one or more sets of electric motors on a single car or number of cars. Compressed air is employed as an agent to operate the master controllers and motor controllers. The arrangement permits the attendant to reverse simultaneously the direction of rotation of all the motors, and afterward to operate, also simultaneously, all the transmitting devices to vary the connecting up of the motors with each other and with the resistances suited to the different speeds given the train.



661,188.—Process of Separating Metals from their Combinations.



661,244.—Electric Cable.

661,456. ELECTRIC CANDLE STICK; L. F. Lewis, New York, N. Y. App. filed Jan. 25, 1900. A casing containing a battery and surmounted by an electric lamp occupies the position of the candle holder in a candle stick and a switch is located conveniently for operation by the finger.

661,458. CURRENT DISTRIBUTER FOR ELECTRIC RAILWAYS; Heinrich Schramm, of Nuremberg, Germany. App. filed May 9, 1900. A contact-button system in which two electromagnets on the car actuate two vertical pivoted arms, the latter in turn moving a horizontal arm which closes and opens the sliding contact circuit; one electromagnet acts to close the circuit and the other to open it.

661,464. ALTERNATING-CURRENT MOTOR; Wales Aldrich and Henry E. Borger, of Dayton, Ohio. App. filed April 30, 1900. The combination with an alternating-current motor of a mechanical starting device, consisting of a ratchet wheel geared to the armature shaft, a pivotal frame mounted adjacent to the armature shaft, a segmental ratchet yieldingly mounted on the frame and adapted to gear with the ratchet wheel on the shaft. A projection on the pivotal frame engages with a switch lever which switches in a circuit for running the motor at its maximum speed. Other circuits may be used after the maximum speed is reached, and corresponding to lower speeds.

661,465. ELECTRICAL SWITCH; N. Bassett, Philadelphia, Pa. App. filed Feb. 8, 1900. The primary object of this device is to provide against the accidental or unintentional leaving open of the telephone circuit by failure to replace or return the switch lever to the initial contact.